

First Five-Year Review Report For Sites 5, 6, 8, and 12 Andersen Air Force Base, Guam

September 2014

**Department of the Navy
Naval Facilities Engineering Command, Marianas
PWD GUAM
PSC 455, BOX 195
FPO AP 96540-2937**



**Indefinite Delivery/Indefinite Quantity Contract
Contract Number N62742-09-D-1953, CTO 009**

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September 2014

Prepared for:



**Department of the Navy
Naval Facilities Engineering Command, Marianas
PWD GUAM
PSC 455, BOX 195
FPO AP 96540-2937**

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Prepared under:

**Indefinite Delivery/Indefinite Quantity Contract
Contract Number N62742-09-D-1953, CTO 009**

EXECUTIVE SUMMARY

This Five-Year Review Report documents the methods, findings, and conclusions of a multi-site Installation Five-Year Review, Andersen Air Force Base, Guam, completed in September 2014. It evaluates whether remedies selected for IRP Sites 5, 6, 8, and 12 for this installation remain protective of human health and the environment. The Record of Decision documents for these sites document the decision that due to the presence of low levels of chemicals in soils at the site, which require restricted land use and limited exposures, land use controls (LUCs) must be implemented.

This Five-Year Review Report has been completed in accordance with the United States Environmental Protection Agency (USEPA) Comprehensive Five-Year Review Guidance, June 2001, USEPA 540-R-01-007, and Office of Solid Waste and Emergency Response No. 9355.77-03B-P. To complete this Five-Year Review Report, all relevant activities that have been performed and data and documents that have been generated since the implementation of remedial action have been reviewed.

Results of this initial Five-Year Review indicate that for Sites 5, 8 and 12, the LUCs remain effective and protective of human health and the environment in the short term, and exposures to contaminated media and associated risks remain controlled. There has been no evidence of excavation or uncontrolled removal of soil from the sites, trespassers or indications of trespassing at the sites, or unauthorized development or new structures at these sites. However, several components of the LUCs for these sites remain to be implemented, and are planned for 2014.

The LUCs at Site 6 are also protective of human health and the environment in the short term. However, one condition of the LUCs was ignored by a contractor working at the site. In 2010, a contractor constructed a laydown/storage yard on the site and moved contaminated soil from a restricted soil pile to an area of the site outside of the LUCs. The contractor also constructed a chain link fence to secure part of the laydown/storage area. This fence is partially located within the LUC boundary. The construction of the laydown/storage yard at the site occurred before LUC signage was installed. The absence of signage was probably a factor in the LUCs not being followed. An investigation is required to determine the cause and provide recommendations for corrective actions. The site is still considered protective in the short term because no restricted uses have occurred and contaminated soil has not left the overall site.

Land use at Sites 5, 8 and 12 remain unchanged since the issuance of the RODs.

- Site 5 (Landfill 7) is a former sanitary landfill that was active in the 1950's. It is currently an active housing area. No LUC signage is posted at this site. The Human Health and Risk Assessment (HHRA) for this site remains valid and the remedy, although not fully implemented, is functioning as intended and is protective of protective of human health and the environment in the short term. LUC's relating to the Base General Plan, surveying and marking site boundaries and posting signage are planned for 2014.
- Site 6 was used as a trench-and-fill operation for burial of asphaltic waste material and waste liquids in the 1940's. It is currently being used as a laydown/storage yard, which

complies with the LUCS for the site. However, the contractor excavated and moved soil outside of the original LUC boundary, which does not comply with the LUCs. LUC signage was installed after the laydown/storage yard was constructed.

- Site 8 (Landfill 10) consists of three sub-sites: Landfill 10A, Landfill 10B and Landfill 10C. Landfill 10C is subject to LUCs. Landfill 10C was used for the disposal of sanitary waste and small quantities of asphalt waste beginning in the 1950's. The HHRA for this site remains valid and the remedy, although not fully implemented, is functioning as intended and is protective of human health and the environment in the short term. LUC's relating to the Base General Plan and surveying and marking site boundaries are planned for 2014.
- Site 12 (Landfill 17) consists of six (6) areas: A, B, C, D, E and F. Areas A and B are subject to LUCs. Site 12 was used for the disposal of sanitary wastes, excess equipment, and NiCd batteries from the 1940's to the 1980's. The HHRA for this site remains valid and the remedy, although not fully implemented, is functioning as intended and is protective of human health and the environment in the short term. LUC's relating to the Base General Plan, GeoBase information system and installation of fencing are planned for 2014.

The next, and Second, five-year review of Sites 5, 6, 8, and 12 is due five years from the USEPA's approval of this review.

Five-Year Summary Form

Site Identification		
Site Name: Site 5 (Landfill 7), Capehart Housing area; Site 6 (Landfill 8); Site 8 (Landfill 10); Site 12 (Landfill 17); Andersen Air Force Base, Guam		
Region: 9	State: Guam	City: Andersen Air Force Base
Site Status		
NPL Status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input type="checkbox"/> Complete		
Site: Sites 5, 6, 8 & 12	Implementation of LUCs date: Site 5: Sep 2007, Site 6: Sep 2007, Site 8: Sep 2007, Site 12: November 2007	
Has site been put into reuse: <input checked="" type="checkbox"/> YES (Site 5: Housing area, Site 6: Laydown/storage yard) <input type="checkbox"/> NO		
Review Status		
Lead Agency: <input checked="" type="checkbox"/> Navy <input type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Other Federal Agency		
Author Name: Gregg Ikehara, Andersen AFB		

Author Title: Chief, Installation Restoration Program	Author Affiliation: Andersen Air Force Base, Environmental Flight
Review period: November 2007 to September 2014	
Date(s) of site inspection: 2008 thru 2013. Most recent inspection: June 13, 2013	
Type of review: Statutory Review	
Review number: <input checked="" type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____.	
Triggering <input checked="" type="checkbox"/> Other (specify): Site 12 Remedial Action Commencement	
Triggering action date: November 2007	
Due date (five years after triggering action date): November 2012	

Issues:

The following LUCs, specified in the RODs, have not been implemented and are planned for 2014:

Site 5:

- In the Base General Plan, identify the designated LUC area as prohibited from further residential development. (The LUCs will be implemented through amendments to the BGP that will effectively act as deed restrictions.)
- Survey and Mark LUC Boundaries and Post Signage: Site 5 will require a survey to locate and install permanent markers to mark the corners of the designated LUC areas. Signs will be posted around the perimeter of the site.
- Notify residents and provide signage to inform residents and utility workers that excavation is prohibited at the site.

Site 6:

- Survey and Mark LUC Boundaries
- The BGP will be amended annually to identify the designated LUC area(s) as restricted from transfer/lease and residential development indefinitely as long as site conditions are not suitable for unrestricted use and unlimited exposure
- Update GeoBase to include areas to be managed under LUCs

Site 8:

- In the Base General Plan, identify the designated LUC area as prohibited from future residential development. (The LUCs will be implemented through amendments to the BGP that will effectively act as deed restrictions.)

- Survey and Mark LUC Boundaries. Perform survey to locate and install permanent markers to mark the corners of the designated LUC areas. Signs will be posted around the perimeter of the site

Site 12:

- Survey and Mark LUC Boundaries
- The BGP will be amended to identify the designated LUC area(s) as restricted from transfer/lease and residential development indefinitely as long as site conditions are not suitable for unrestricted use and unlimited exposure
- Update GeoBase to include areas to be managed under LUCs
- Chain link fence shall be installed at access points at the top of Areas A and B to limit access to the designated LUC areas

Recommendations and Follow-up Actions:

All sites:

Site 6: In the development Site 6 as a laydown yard, contaminated soil was spread out over the site. The Navy should investigate the actions and omissions that led to the LUCs at Site 6 not being followed. Specifically, the Navy should determine which LUCs were not implemented or followed and how to prevent such occurrence in the future. A report with recommendations for corrective actions should be prepared.

Summary of Recommendations and Follow-up Actions

Recommendations / Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current	Future
Full Implementation of all LUCs for all sites	Navy	USEPA	December 31, 2014	No	Yes
Investigation regarding why LUCs were not followed at Site 6	Navy	USEPA	June 30, 2015	No	Yes

Protectiveness Statement(s):

Site 5: The remedy at this site is protective of human health and the environment in the short term. It will be fully protective after the LUCs have been fully implemented. Exposure pathways that could result in unacceptable risks will be controlled through the clean soil cover, and the implementation of institutional controls.

Site 6: The remedy at this site is protective of human health and the environment in the short term. It will be fully protective after the LUCs have been fully implemented. Exposure pathways that could result in unacceptable risks are being controlled. However, portions of the LUCs at this site have not been followed and an investigation is required to determine the cause and provide recommendations for corrective actions. Although contaminated soil was moved from a restricted portion of the site to a unrestricted portion of the site, the use of the entire area as a

construction laydown yard is compatible with established LUCs which allow for industrial use.

Site 8: The remedy at Site 8 is protective of human health and the environment in the short term. It will be fully protective after the LUCs have been fully implemented. Exposure pathways that could result in unacceptable risks will be controlled through partial fencing, signage, and the implementation of institutional controls.

Site 12: The remedy at Site 12 is protective of human health and the environment in the short term. It will be fully protective after the LUCs have been fully implemented. Exposure pathways that could result in unacceptable risks will be controlled through partial fencing, signage, and the implementation of institutional controls.

Other Comments:

Future five-year reviews are necessary because contamination remains at concentrations above levels that would allow for unrestricted land use and unlimited exposure. The next Five Year Review is due five years from the USEPA's approval of this review.

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ACRONYMS AND ABBREVIATIONS

AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
ARAR	Applicable or Relevant and Appropriate Requirement
BGP	Base General Plan
bgs	below ground surface
BTV	Background Threshold Value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Civil Engineer Squadron
CEV	Civil Engineer Environmental Flight
CFR	Code of Federal Regulations
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
Cr	Chromium
CTO	Contract Task Order
cy	cubic yard
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DERP	Defense Environmental Restoration Program
DON	Department of the Navy
DSI	Detailed Site Inventory
EA	EA Engineering, Science, and Technology, Inc.
EC	Engineering Control
EE/CA	Engineering Evaluation/Cost Analysis
EO	Executive Order
EOD	Explosive Ordnance Disposal
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
ESE	Environmental Science and Engineering
°F	degrees Fahrenheit
FFA	Federal Facility Agreement
FS	Feasibility Study
GEPA	Guam Environmental Protection Agency
GTI	Groundwater Technology, Inc.
HARM	Hazard Assessment Rating Methodology
HHRA	Human Health Risk Assessment
IC	Institutional Control
ICF	ICF Technology, Inc.
IR	Installation Restoration
IRP	Installation Restoration Program
LTGM	Long Term Groundwater Monitoring
LUC	Land Use Control

LUCMP	Land Use Control Management Plan
MSA	Munitions Storage Area
msl	mean sea level
NAVFAC Pacific	Naval Facilities Engineering Command, Pacific
NAVFAC Marianas	Naval Facilities Engineering Command, Marianas
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NGL	Northern Guam Lens
NiCad	nickel-cadmium
NPL	National Priorities List
NTCRA	Non-Time-Critical Removal Action
OEW	Ordnance or Explosive Waste
OSWER	Office of Solid Waste and Emergency Response
OU	Operational Unit
PAH	Polynuclear Aromatic Hydrocarbons
PCBs	polychlorinated biphenyl
PCR	PCR Environmental, Inc.
POL	petroleum, oil, and lubricants
PRG	Preliminary Remediation Goal
RA	Remedial Action
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Agreement
RG	Remediation Goal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RSL	Regional Screening Level
RVR	Remediation Verification Report
SARA	Superfund Amendments and Reauthorization Act of 1986
SAIC	Science Applications International Corporation
SRA	Screening Risk Assessment
SVOCs	Semi Volatile Organic Compound
TAL	Target Analytes List
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Service
USN	United States Navy
VOCs	Volatile Organic Compounds
WSA	Weapons Storage Area

1. Introduction

On 14 October 1992, the USEPA Region IX formally listed Andersen Air Force Base (AFB) on the National Priorities List (NPL) with a Comprehensive Environmental Response, Compensation, and Liability Information System identification number of GU6571999519. By 30 March 1993, the United States Air Force (USAF) entered into a Federal Facility Agreement (FFA) with the USEPA and the Guam Environmental Protection Agency (GEPA) and began its Superfund clean-up program in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Under the CERCLA, Andersen AFB is required to conduct a Five-Year Review every five years for sites where waste is left in place. This Five-Year Review has been prepared for Main Base Sites 5, 6, 8, and 12, for the Department of the Navy (DON), Naval Facilities Engineering Command, Marianas (NAVFAC Marianas), under contract task order (CTO) number (No.) 0009 of the U.S. Navy Indefinite Delivery/Indefinite Quantity Contract No. N62742-09-D-1953 of 08 April 2010.

This Five-Year Review was prepared pursuant to CERCLA §121 and the NCP. CERCLA §121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

This report was prepared according to the USEPA Comprehensive Five-Year Review Guidance (USEPA, 2001) and complies with the following laws, regulations, and policies:

- *Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Pub. L. 99-499 (CERCLA)*
- *National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300 et seq.)*
- *Executive Order (EO) 12580 (52 FR 2923), as amended by EO 12777 (56 FR 54757) and EO 13016 (61 FR 45871)*
- *Defense Environmental Restoration Program (10 U.S.C. § 2705 et seq.)*
- *Policy for Conducting CERCLA Statutory Five-Year Reviews (DON 7 June 2011)*

1.1 The Purpose of the Five-Year Review

The purpose of a five-year multisite review is to evaluate if remedies implemented at Andersen AFB are protective of human health and the environment. To do this, all relevant activities that have been performed and data and documents that have been generated since the

implementation of remedial action are reviewed. If necessary, recommendations are provided to close any data gaps and improve the effectiveness of the remedial action in protecting human health and the environment.

1.2 Overview of the Five-Year Review Process

This Five-Year Review is mandated as part of the Superfund Amendments and Reauthorization Act of 1986 (SARA), which amended the CERCLA. A five-year review is applicable to sites that a ROD was signed on or after 17 October 1986, the effective date of the SARA. According to CERCLA §121(c), as amended: *“a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the congress a list of facilities for which such review is required, the results of all such reviews, and any action taken as a result of such reviews.”* This requirement is further defined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); 40 C.F.R Part 300.430(f)(4)(ii), and states that: *“If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the remedial action.”* According to USEPA guidelines (USEPA, 2001), a five-year review is triggered when a remedial action (RA) results in residual hazardous materials, pollutants, or contaminants remaining at a site above concentrations that would allow unlimited use and unrestricted exposure of the site. The sites under review fall within this description.

This document is issued by the United States Navy (USN), as the lead agency. The USN is managing the Main Base OU Sites listed above in accordance with CERCLA as required by the Defense Environmental Restoration Program (DERP). The USN and the USEPA have jointly selected the remedies and the Guam Environmental Protection Agency (GEPA) has concurred with the decision, under the guidelines established in the FFA signed in February 1993 by representatives of the USEPA Region 9, GEPA, and the USAF (USEPA et al., 1993).

1.3 Review Synopsis

This five-year review report documents the methods, findings, and conclusions of a four-site Installation 5-Year Review, Andersen Air Force Base, Guam, initiated in February 2012 and completed in September 2014. It evaluates whether remedies selected for these four sites for this installation remain protective of human health and the environment.

The Record of Decision documents for these sites document the decision that due to the presence of low levels of chemicals in soils at the site, which require restricted land use and limited exposures, land use controls (LUCs) must be implemented.

The optimization reviews for these sites are not included in this Five-Year Review.

Review of current environmental conditions indicates that the LUCs and other remedial measures at Sites 5, 8 and 12 remain effective and protective of human health and the environment in the short term. However, components of the remedies have not been fully

implemented to be protective in the long term and corrective measures are needed. Exposure to contaminated media and associated risks remain controlled.

At Site 6 one condition of the LUCs was ignored by a contractor working at the site. In 2010, a contractor constructed a laydown/storage yard on the site and moved contaminated soil from a restricted soil pile to an area of the site outside of the LUCs. The contractor also constructed a chain link fence to secure part of the laydown/storage area. This fence is partially located within the LUC boundary. The construction of the laydown/storage yard at the site occurred before LUC signage was installed. The absence of signage was probably a factor in the LUCs not being followed. An investigation is required to determine the cause and provide recommendations for corrective actions. The site is still considered protective in the short term because no restricted uses have occurred and contaminated soil has not left the overall site.

In order to meet U.S. EPA requirements, future additional, or replacement, signs should state at a minimum the following: Warning – No Trespassing, Contaminated Area, Avoid Contact with Soil. Contact Base Environmental at (671) 366-4692 prior to planning any excavation or construction activities.

1.4 Base General Plan (BGP)

The Base General Plan (BGP) is required to be amended within sixty (60) days of ROD approval to identify the designated LUC area(s) as restricted from transfer/lease and residential development indefinitely as long as site conditions are not suitable for unrestricted use and unlimited exposure. Air Force Instruction (AFI) 32-7062 (Air Force Comprehensive Planning) requires that installations develop and maintain a BGP as a central repository for information deemed essential for planning and managing the installation's physical assets, including environmental planning constraints such as the LUCs. AFI 32-1021 (Planning and Programming Military Construction Projects) requires installations to comply with their BGP to ensure that there are no conflicts with land-use constraints stemming from the LUCs of the Environmental Restoration Program (ERP) that would impact facility planning and construction. Any requests for residential use or invasive activities (i.e., construction) through excavation permits, such as AF Form 103, or the construction review process, as per AFI 32-1001 (Operations Management), will be denied, unless the procedures for proposed land use changes described in the approved ROD, and amended to the BGP, are followed. The LUCs amended to the BGP will be monitored, maintained, and reported on through existing land-use management programs, such as the Base Civil Engineering Work Clearance Form (AF Form 103) (dig permit) and the construction review process (AFI 32-1001). No construction or digging will be permitted without prior approval by the BCE in the form of an approved work clearance (dig permit) or other approvals as required by applicable AFI. The BCE will not approve dig permits for activities inconsistent with the LUCs as amended to the BGP and no changes in the type of land use designated in the ROD shall be implemented within the designated LUC area without the prior knowledge and concurrence of the USAF, USEPA and GEPA. These procedures involve a minimum of sixty (60) day notice to USEPA and GEPA. These requirements shall be reviewed annually as part of the LUCMP and once every five years as part of the Five-Year ROD Review process. These requirements shall remain in effect indefinitely as long as COCs in subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

1.5 Land Use Control Management Plan (LUCMP)

The Land Use Control Management Plan (LUCMP) serves as the operational “road map” for defining, implementing, and reporting on LUCs at these sites. The LUCMP is maintained by 36 CES/CEVR to assure that activities within the designated LUC area are implemented in accordance with the remedy selected in the approved ROD. The LUCMP includes protocols for: (1) daily management of the LUCMP process; (2) annual inspections of LUC sites to ensure compliance with the LUCs; (3) specifications for annual LUC-compliance reporting requirements; (4) property lease or transfer (note: currently, there are no plans for property lease or transfer); (5) LUC modification or termination; and (6) notification process and relevant corrective actions for LUC non-compliant events. While monitoring/implementing the LUCs at these sites, activities that are inconsistent with the LUC objectives or designated land use restrictions will be addressed by the Navy as soon as practicable. The USEPA and GEPA will be notified of significant inconsistencies or deficiencies within fifteen (15) days after the Navy becomes aware of the situation, at which time the Navy will provide appropriate recommendations for corrective actions. The LUCMP will be reviewed annually to assure that land use restrictions and controls are maintained as per the remedy selected in the ROD. The annual LUCMP monitoring reports will summarize (1) monitoring activities performed in the prior year; (2) notable deficiencies or inconsistencies in maintaining the LUCs; (3) corrective actions taken; and (4) effectiveness of the corrective actions. The annual LUCMP monitoring reports will be used in preparation of the Five-Year Review to evaluate the effectiveness of the remedy. The LUCs will remain in effect indefinitely as long as COCs in subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

1.6 Location of Sites

Guam is the largest of the Mariana Islands and is located in the western Pacific Ocean between 13°15' and 13°39' north latitude and 144°37' and 144°57' east longitude, approximately halfway between Japan and New Guinea. The island has an area of nearly 209 square miles and is approximately 30 miles long and 4 to 8 miles wide.

Andersen AFB is located in the northern half of the island and consists of several parcels of land in the northern half of the island. The largest contiguous portion of Andersen AFB property consists of the Main Base and Northwest Field, which together are approximately 8 miles wide, 2 to 4 miles long, and 24.5 square miles in area. The active base operations are located at the Main Base and Northwest Field. The Main Base and Northwest Field are bounded by the Rota Channel to the north, the Philippine Sea to the west, and the Pacific Ocean to the east.

1.7 Report Organization

This report is organized by site, and follows the USEPA guidance document for preparing a Five-Year Review. Information common to all sites is presented below in Sections 1.6 thru 1.9.

1.8 Physical Characteristics

Guam lies about 13° 27' (about 900 miles) north of the equator, creating a year-round warm climate. The average annual temperature is 81 degrees °F. Daily temperatures on the island range from the low-70s to the mid-80s. The mean monthly temperatures range from 80 °F during January to about 82 °F in June. Temperatures rarely exceed 90 °F during the daytime hours or fall below 70 °F at night. Humidity ranges from between 65 to 80 percent in the late afternoon and 85 to 100 percent at night, with a monthly average of at least 66 percent.

Easterly trade winds are common throughout the year and prevail from January to May. The annual rainfall at Andersen AFB averages 90.8 inches per year. Large rain events associated with typhoons are not uncommon, with as much as 24.9 inches of precipitation during a 24-hour period. There are only two seasons on the island, wet and dry. The wet season extends from July to November and the dry season extends from December to June.

Andersen AFB is located on an undulating limestone plateau with sinkholes and other karst features. The surface elevation of the northern plateau at Andersen AFB ranges from approximately 500 feet above mean sea level (msl) to approximately 625 feet above msl.

Guam is the largest of the Mariana Islands and is located in the western Pacific Ocean between 13°15' and 13°39' north latitude and 144°37' and 144°57' east longitude, approximately halfway between Japan and New Guinea. The island has an area of nearly 209 square miles and is approximately 30 miles long and 4 to 8 miles wide. Andersen AFB is located in the northern half of the island, on a broad undulating limestone plateau overlying a volcanic core. It is bounded on the east, north, and west by cliffs rising approximately 500 feet above msl.

Andersen AFB consists of several parcels of land in the northern half of the island. The main portion of Base property consists of the Main Base and Northwest Field, and together they are approximately 8 miles wide, 2 to 4 miles long, and 24.5 square miles in area. The Main Base is the center of active operations, and Northwest Field has been generally inactive since the mid-1950s. Northwest Field, a 2,130-acre property located in the northernmost portion of Guam, is bounded by the Rota Channel to the north, the Philippine Sea to the west, and the Main Base to the east.

1.9 Geology and Soils

Guam is located within the frontal arc of the Mariana Islands, which also includes the islands of Rota, Tinian, and Saipan. The frontal arc is composed of Eocene- to Miocene-age volcanic rocks locally intercalated with and overlain by shallow water marine limestone and other sediments. Pre-late Miocene alkaline lavas are exposed on Guam as well as on Saipan.

The island of Guam consists of two major geologic provinces, a limestone plateau in the north and a dissected volcanic upland in the south. The surface of the northern plateau, which includes the Main Base Operable Unit (OU), is characterized by karst topography and contains numerous sinkholes. The northern plateau contains a variety of reef facieses, from lagoon sediments to compact fore reef strata. No distinct surface drainage pattern occurs on the upper limestone plateau of the island, due to the rapid infiltration rates that allow most rainfall to percolate directly into the highly permeable limestone bedrock.

The limestone formations found on the northern plateau of Guam are the Barrigada and Mariana Limestones. The Main Base and MARBO OUs are located on the northern plateau of Guam and contain these limestone formations. The Barrigada Limestone, which can be as thick as 540 feet, is a massive, well-lithified to friable, medium- to coarse-grained, white, foraminifera limestone. The younger Mariana Limestone overlies the Barrigada Limestone and is exposed on the surface of most of the northern plateau. The Mariana Limestone consists of a transgression facieses that is composed of deep water to shallow water deposits. Karst features such as sinkholes, caves, and cenotes have formed within the limestone formations by geomorphic activity.

Sites are all underlain by the soil of the Guam-Urban land complex. This soil unit is composed of 55% Guam Cobbly Clay Loam and 45% urban land. Typically these soils occur on limestone plateaus and have been disturbed by landscaping and development. The Guam Cobbly Clay Loam is derived from sediments overlying porous coralline limestone. It is neutral to mildly alkaline with moderately rapid permeability. The surface layer is usually removed or mixed with underlying material during construction. The subsoil is approximately 38 inches thick and is a dusky, red, cobbly clay. The depth to limestone is usually 12 to 60 inches, unless landscaping has taken place.

1.10 Hydrology

On the northern half of the island, potable drinking water comes primarily from porous limestone deposits in the Barrigada and Mariana Limestones. This aquifer, called the Northern Guam Lens (NGL), occurs as a freshwater lens floating on seawater (as per the Ghyben-Herzberg Lens principle). The water table elevation ranges from near sea level at coastal areas to a maximum of about 6 feet above msl. The NGL has been designated as a sole-source aquifer by the USEPA (Barrett, Harris & Associates, 1982). The saturated thickness of the freshwater lens can be in excess of 200 feet. Discharge of the unconfined freshwater aquifer lens is toward the coast along localized hydraulic gradient flow lines.

Little or no significant surface drainage to the sea occurs on the northern half of the island. The limestone surface is extremely permeable and rainwater infiltrates quickly downward through the interconnected pore space of the unsaturated (vadose) zone and into the saturated zone forming the basal aquifer (Stearns, 1937; Mink, 1976). Some surface runoff does occur on the slopes of Mataguac Hill and Mt. Santa Rosa, but the water eventually seeps into the limestone. Discharge of freshwater springs along the coastline occurs locally as flow through openings and fissures in the highly permeable coralline facieses of the limestone formations.

The basal portions of the limestone aquifers in northern Guam have an average hydraulic gradient of 0.5 feet per 1,000 feet (i.e., 0.0005), a hydraulic conductivity of between 1,000 to 2,000 feet per day, and total porosity ranging from 15 to 25% (Stearns, 1937; Mink, 1976). The gradients of the parbasal portion of the aquifers are even greater. By definition, basal groundwater is freshwater floating above seawater, and parbasal groundwater is freshwater that lies on impermeable basement (Young, 1988).

1.11 Regional Surface Water Hydrology

The limestone porosity is estimated to be as high as 30% (CDM/BHA, 1982).

Due to the high porosity and permeability of the limestone on the northern half of Guam, standing water is rare, and streams, rivers, and surface waters do not exist.

2. Site 5

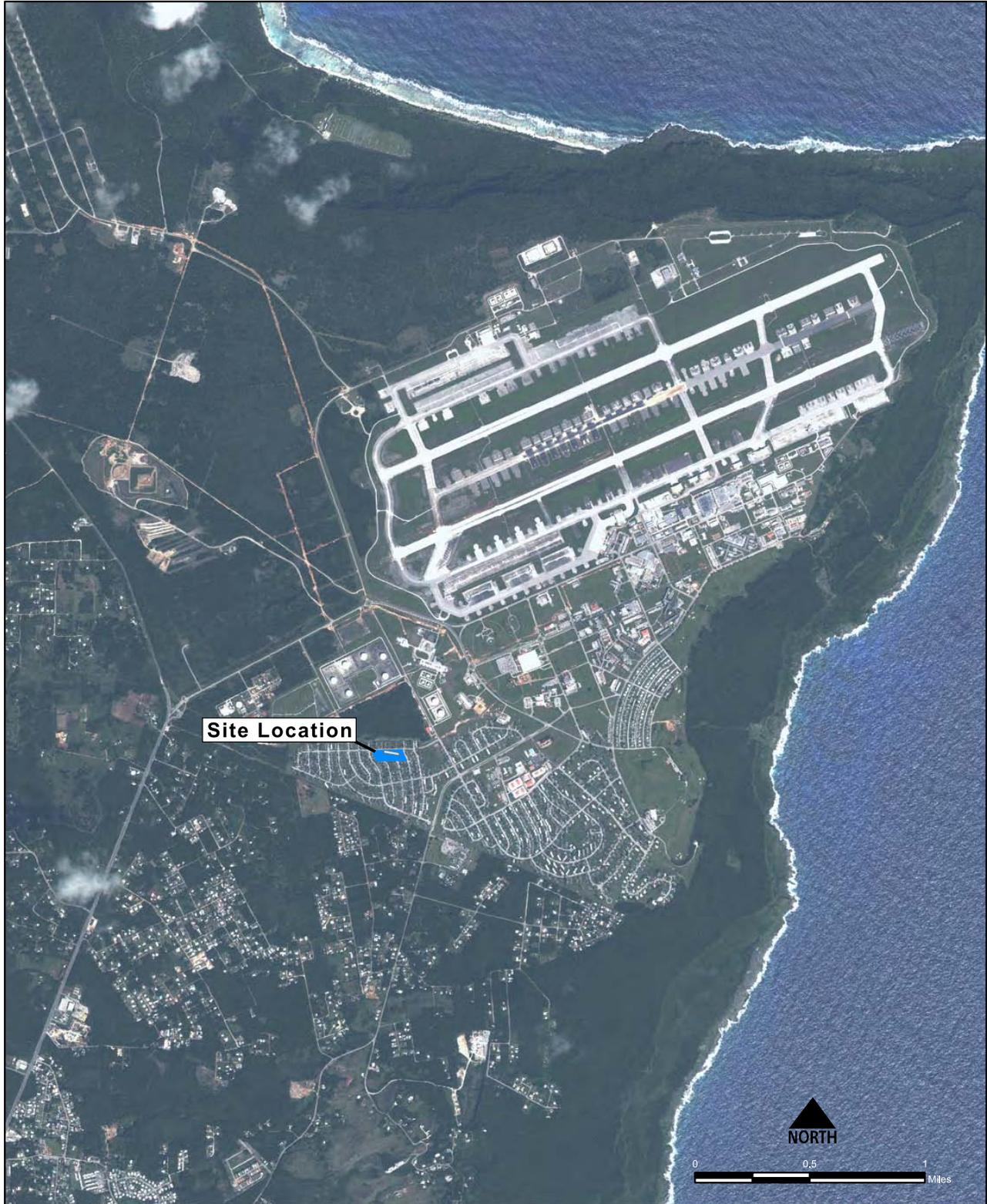
2.1 Introduction

The purpose of this Five-Year Review report is to determine whether the remedy at Site 5, Andersen Air Force Base, Guam (Figures 1-1 & 1-2) is protective of human health and the environment by reducing the potential for exposure to low levels of chemicals in soil at the site. This Five-Year Review report is required due to contamination above levels which would allow for unrestricted land use and unlimited exposure.

This Five-Year Review report identifies issues found during this review, if any, and lists recommendations to address them.

This site's LUCs are presented below:

LUC Requirement/Description	LUC Interval	Starting Date
In the Base General Plan, identify the designated LUC area as prohibited from further residential development. (The LUCs will be implemented through amendments to the BGP that will effectively act as deed restrictions.)	Annually	Planned for 2014
Survey and Mark LUC Boundaries and Post Signage: Site 5 will require a survey to locate and install permanent markers to mark the corners of the designated LUC areas. Signs will be posted around the perimeter of the site.	Initially	Planned for 2014
Notify residents and provide signage to inform residents and utility workers that excavation is prohibited at the site.	Initially	Planned for 2014
Preserve the integrity of existing site structures (e.g., houses, patios, roads) within the Site 5 area unless there is a USAF-approved plan for the work and restoration.	Initially	September 2007
Maintain the landscaping (e.g., erosion controls) and structures (e.g., buildings, patios, roads) at Site 5 in accordance with an approved Operation and Maintenance (O&M) plan.	Initially	September 2007
Require Dig and Construction Permits prior to intrusive activities within the LUC area.	Initially	September 2007
Perform annual site inspection and prepare Compliance Summary Report	Annual	December 2008
Perform formal 5-year reviews as required by CERCLA. The 5-year reviews will continue as long as COCs remain at levels above those suitable for unrestricted use of the site	Once Every Five Years	2014



Project: Five-Year Installation Review Report

Description: Location of Site 5

Figure
2-1



Project: Five-Year Installation Review Report

Description: LUC Site Diagram of Site 5

Figure
2-2

2.2 Site Chronology

Table 2-1: Chronology of Site Events for Site 5

Event	Date
Site Construction	1956
Disposal of sanitary and industrial wastes	1956-1958
Site closed	1958
Site partially excavated	1958
Phase 1 Records Search	1985
RCRA Facility Assessment	1986
Initial Community Relations Plan	1993
Federal Facility Agreement (FFA)	1993 Mar
Updated Community Relations Plan	1998
Restoration Advisory Board (RAB)	1995
Final Records Search	1996
Engineering Evaluation/Cost Analysis for site	2000
NTCRA	2001
Final Management Action Plan	2001 Dec
RVR – Remediation Verification Report	2002
Remedial Investigation/Feasibility Study (RI/FS)	2007
ROD	2007 Aug
HHRA and SRA (in Remedial Investigation (RI))	2007
Public meeting to present Proposed Plan	2007
Annual LUC Inspections	2008 - 2013
Land Use Control Management Plan (LUCMP)	2012 Sep
Annual LUC Inspection	2013
5 Year Review Report: Initial	2014

2.3 Background

Site 5 is located in the south central portion of the Main Base, within Andersen AFB’s Capehart Housing Area (an active family housing area for USAF personnel). It contains 13 dual-family, single-story, ranch-style residential homes on the northern ends of Bataan, Hibiscus, and Gecko Lanes. Each residential unit includes a backyard patio, a carport, and a driveway. The area is landscaped and maintained by the Navy with grass lawn and shade trees. Carabao Avenue forms the northern boundary of Site 5. There are two buildings contained within the area affected by the LUCs. Underground utilities are present.

The restricted area of the site is approximately 0.4 acres. There is no fencing to restrict access to the site; however, the areas of contaminated soil are located over 6 feet bgs or beneath an existing building foundation.

There are no plans for the Navy to lease or transfer the property. The designated LUC area is prohibited from further residential development as long as the site conditions are not suitable for unrestricted use and unlimited exposure. In addition, disturbance of soil and existing structures within the designated LUC area is prohibited.

2.3.1 History of Contamination

The USAF reportedly used Site 5 in the late 1950s for the disposal of sanitary wastes, industrial wastes, and other debris using a trench/fill method. The site consisted of a shallow excavated trench filled with metallic, concrete, wood, and solid construction debris. Soil cover was used to close the disposal area prior to construction of the Capehart Housing Area in 1958. Sections of the landfill were excavated during construction of the housing area in 1958. The remainder of the landfill was covered with soil as part of the grading and landscaping activities. Based on a records review (ICF, 1996), the landfill trench dimensions were estimated to be 400 feet long by 15 feet wide, with the ends flaring to 30 feet wide.

Site 5 was one of 26 landfills at Andersen AFB identified in the Installation Restoration Program (IRP) Phase I Records Search. The site was described in the report as approximately three acres in size and located beneath the housing area bordered by Wake, Kwajalein, and Guadalcanal Lanes. According to the report, the site was used between 1956 and 1958 for the disposal of Base sanitary trash utilizing a trench/fill method. Based on the limited information available, the report concluded that the landfill had minimal potential for contamination or hazardous leachate formation. The site was deleted from further consideration at that time.

The Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (SAIC, 1986) included Site 5 as one of sixty-three Solid Waste Management Units identified on Andersen AFB. Site 5 was noted as a potential source of subsurface gas generation due to reported putrescible waste types and the then-current land use practices. Reportedly, no known release controls were employed while the landfill was active. The report stated that there was no known potential for past or ongoing releases to soil, groundwater, or air by hazardous contaminants. The RFA did acknowledge that the landfill received municipal-type refuse, which may have contained putrescible materials, and concluded there was the potential that methane might be generated by the landfill.

The Base wide Work Plan for OU 6 (ICF, 1994a) reiterates the information from the previous reports. Because of a lack of physical and documented evidence concerning the exact boundary and location of the landfill, an exaggerated area approximately 14 acres in size was chosen to represent the site for the purposes of the RI/FS. Caraboa Avenue, Tarague Avenue, and Pacific Lane formed the borders of the expanded 14-acre site, incorporating the original 3-acre site delineated by the IRP Phase I Records Search (ESE, 1985).

According to the 1996 Records Search (ICF, 1996), no written documentation pertaining to the use and operation of this landfill was made available during the June 1993 and June 1994 investigation. According to the report, construction drawings and a Master Plan were identified and reviewed but they provided no information that could be documented concerning whether the area was being used or had been used as a landfill. One Andersen AFB employee interview was included in the 1996 Records Search Report. The employee was one of the first occupants of the Capehart Housing Area when it was opened in 1959, but the individual did not recall any landfills located east of the Base access road (Arc Light Boulevard).

Capehart Housing Area construction documents reviewed during the RI/FS focused on two areas: one delineated as the site by the Base wide Work Plan for OU 6 (ICF, 1994a); and one coinciding with a clearing observed in a 1956 aerial photograph. A landfill trench labeled "existing sanitary fill" was identified in the clearing observed in the 1956 aerial photograph. On the 1957 Electrical Distribution Plan of Area 10 and Area 11, the landfill is clearly shown as trending east west below houses along the northern end of Gecko, Hibiscus, and Bataan lanes.

The landfill dimensions, based on the plan scale, were 400 feet long by 15 feet wide, with the ends flaring to 30 feet wide. Portions of the sanitary fill were located under the planned locations for houses and roads that were to be excavated to firm ground, backfilled to the finished grade, and compacted. The topographic maps also show the locations of 70 “borehole tests” in the area of the landfill trench. Fifteen of the boreholes contained layers labeled “trash/junk.”

2.3.2 Initial Response

In 2000, the USAF prepared an Engineering Evaluation / Cost Analysis (EE/CA) in support of a CERCLA non-time-critical removal action (NTCRA) to address unacceptable non-cancer risks in subsurface soil associated with the utility worker and residential risk scenarios (EA, 2000a). No unacceptable risks were identified for surface soil. Antimony, lead, and tetrachlorodibenzo-p-dioxin (TCDD)-toxicity equivalent (i.e., dioxins) were identified as the COCs in subsurface soil for the utility worker exposure scenario. Antimony, manganese, and dioxins were identified as the COCs in subsurface soil for the future adult resident scenario.

The USAF selected a *Limited Soil Removal to Six Feet* alternative as the preferred NTCRA for Site 5. The rationale for excavating to 6 feet below ground surface was based on the likelihood that future underground utility construction projects could transfer subsurface fill debris to the surface. The depth of the excavation was limited to 6 feet bgs because excavations associated with the repair or upgrade of underground utilities at the site are not anticipated to be greater than 6 feet. Fill material deeper than 6 feet bgs, containing hazardous substances exceeding remedial goals (RGs), was left in place, but capped with clean backfill to prevent an exposure pathway to human receptors.

In 2001, the USAF excavated approximately 1,688 loose cubic yards of soil from four excavation areas (GTI, 2002).

The RI (EA, 2007a) was conducted to identify and characterize the contaminants of potential concern (COPCs) at the site and evaluate risks to human health and the environment. During the RI, surface and subsurface soil samples were collected at Site 5. A total of 32 surface soil samples were collected at Site 5. Nineteen of the 32 surface soil samples and two duplicate samples were analyzed for the following parameters:

- Semi volatile organic compounds (SVOCs), USEPA Method SW8270C
- Polycyclic aromatic hydrocarbons (PAHs), USEPA Method SW8310
- Cyanide, USEPA Method SW9012
- Andersen AFB target analytes list (TAL) metals, USEPA Method SW6010B/SW7000 series

Ten additional surface soil samples and one duplicate sample were analyzed for dioxins/furans.

- Dioxins/Furans, USEPA Method SW8290.

Surface soil samples were not analyzed for volatile organic compounds (VOCs) because geologic and climatic conditions on Guam induce volatilization and infiltration, thereby limiting the potential presence of VOCs in surface soil samples.

A total of 11 subsurface soil samples (including two duplicate samples) were collected so that buried waste materials could be characterized and the potential risks to human health and the environment could be evaluated. Subsurface soil samples were collected from the bottom of test pit excavations at depths ranging from 2.5 to 10 feet bgs, the results of which are

summarized in the ROD for Site 5 (EA, 2007b). Subsurface soil samples were analyzed for:

- VOCs
- SVOCs, USEPA Method SW8270C (seven samples including one duplicate)
- PAHs, US EPA Method SW8310 (seven samples including one duplicate)
- Dioxins/Furans, USEPA Method SW8290 (six samples including one duplicate)
- Cyanide, USEPA Method SW9012 (seven samples including one duplicate)
- Andersen AFB TAL metals, USEPA Method SW6010B/SW7000 series (seven samples including one duplicate).

Site 5 has been evaluated in the following seven environmental reports:

- *Installation Restoration Program Phase I: Records Search, Andersen Air Force Base, Guam.* (ESE, 1985)
- *RCRA Facility Assessment a/Solid Waste Management Units at Andersen AFB, Guam, USA.* (SAIC, 1986)
- *Final Base wide Work Plan for Operable Unit 6, Andersen Air Force Base, Guam.* (ICF, 1994a)
- *Final Records Search for Andersen Air Force Base.* (ICF, 1996)
- *Final Engineering Evaluation/Cost Analysis (EE/CA) for IRP Site 5/Landfill 7, Andersen Air Force Base, Guam.* (EA, 2000a)
- *Remediation Verification Report, Interim Remedial Actions, Installation Restoration Program Site 5/Landfill 7, Main Base OU, Andersen Air Force Base, Guam (Groundwater Technology, Inc. (GTI, 2002)*
- *Remedial Investigation/Feasibility Study for Sites 1, 5, 8, 32, and 33, Main Base Operable Unit, Andersen Air Force Base, Guam* (EA, 2007a).

2.3.3 Basis for Taking Action

Based on the identified unacceptable human health risks associated with exposures to COCs in subsurface under a future residential scenario, the response action selected in the ROD was necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

There are no unacceptable risks to ecological receptors. With the completion of a NTCRA, there are no unacceptable risks to human health associated with surface soil. Unacceptable non-cancer risks to human health were identified for resident adults/children and utility worker exposure to subsurface soil.

Contaminants of Concern (COCs): Antimony, copper, lead, and manganese.

2.4 Remedial actions

2.4.1 Remedy Selection

Institutional Controls (ICs) followed an already-completed NTCRA.

Using USEPA guidelines for screening remediation technologies (40 CFR 300.430[e] [7]), numerous remedial technologies for soil were considered at Site 5 (EA, 2007a). Many of these were eliminated from further consideration because they were not feasible for the physical and chemical properties of the Site 5 COCs and/or the unique environmental setting of the site. The remaining remedial technologies that were potentially feasible for the mitigation of Site 5 risks were screened according to their effectiveness, implementability, and, to a lesser extent, cost. Based on the remedial technology and alternative screenings, the following two remedial alternatives were retained for detailed analysis at Site 5:

- No Further Action (NFA)
- Institutional Controls (ICs)

The primary rationale for selecting the ICs as a remedial alternative for Site 5 is that the USAF, USEPA Region 9, and GEPA have agreed that the ICs alternative would control exposures to resident adults and children and utility workers by prohibiting construction, which would disturb the contaminated subsurface soil and expose residents and workers to COCs. The ICs alternative will augment the NTCRA already completed at Site 5 to protect human health and the environment. As presented in the ROD, the ICs alternative has advantages over the NFA alternative. The ICs alternative:

- will meet RAOs, unlike the NFA alternative.
- will be protective of human health and the environment, unlike the NFA alternative.

2.4.2 Remedy Implementation

The selected remedy does not include the removal of remaining contaminated soil from the site, but is a follow-up action to a completed 2001 NTCRA that included the excavation of contaminated soil to a depth of 6 feet below ground surface. The selected remedy will result in contaminated subsurface soil remaining on site at concentrations that could pose potential unacceptable risks to future residents and utility workers. Following the NTCRA, clean soil was backfilled into the excavated area and no unacceptable risks are associated with surface soil. LUCs are required to control direct exposure to the remaining contaminated subsurface soil/wastes and to eliminate unacceptable exposure pathways.

Site 5 is located on the active portion of the Main Base and there are no plans for the Navy to lease or transfer the property. In the event the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. In the event of a transfer of the property the Navy will provide the USEPA and GEPA with six (6) months prior notice to the transaction so that they can be involved in the process to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. In addition the Navy has agreed to provide the USEPA and GEPA with similar notice, in the event of a federal-to-federal transfer of property. Upon completion of the transfer the Navy shall provide a copy of the executed deed or transfer document(s) to the USEPA and GEPA.

In general, no intrusive activities shall occur within the designated LUC area at Site 5. All dig and construction permits relevant to Site 5 will be documented in the LUCMP for Site 5. If intrusive activities were necessary within the designated LUC area they would require prior approval of 36 CES/CEVR. If intrusive activities were conducted within the designated LUC area, the work would require an approved health and safety plan and procedures for the proper handling and disposal of displaced wastes and/or soils. This requirement shall be subject to an annual review and will remain in effect indefinitely as long as COCs in subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

No fencing is required for this site.

2.5 Progress Since the Last Five –Year Review

This is the first five-year review for this site.

2.6 Five-Year Review Process

2.6.1 Administrative Components

Andersen AFB has conducted a five-year review of the remedial actions implemented at Site 5. This review was conducted from February 2012 to September 2014. This report documents the results of the review. The review was conducted by PCR Environmental, Inc. under Contract Task Order 009 of Contract N62742-09-D-1953.

2.6.2 Community Notification and Involvement

Agency and public participation in the decision process for environmental activities has been encouraged throughout the site closure processes. Community and regulatory agencies have provided regulatory input through periodic RAB meetings. These meetings will continue until the CERCLA processes are complete. Information concerning the five-year review process and its findings will be presented to the public during these routine project team meetings. The last RAB meeting was held in September 2012; however, Site 5 was not discussed during this meeting.

2.6.3 Document Review

This five-year review consisted of a review of relevant documents including the Land Use Control Management Plan for Andersen AFB, annual LUC inspection reports, and groundwater monitoring data. The 2007 ROD was reviewed for site history and remedial actions. The ROD was also reviewed, along with applicable ARARs, such as the 2004 EPA PRGs and 2013 EPA RSLs, for the discussion of exposure assumptions, toxicity data, cleanup levels and remedial action objectives for the site. A list of these documents is presented below:

- *Final Record of Decision for Sites 5 and 8 Main Base Operable Unit, Andersen Air Force Base, Guam. August. (EA, 2007b)*
- *Final Spring 2008 Groundwater Monitoring Report for Andersen Air Force Base, Guam (EA, 2008)*
- *Final Fall 2008 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2009a)*
- *Final Spring 2009 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2009b)*

- *Final Fall 2009 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (EA, 2010a)
- *Final Spring 2010 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (EA, 2010b)
- *Final Spring 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (PCR, 2011a)
- *2011 Annual LUC Monitoring Checklists for IRP Site 5, Andersen AFB, Guam* (PCR, 2011b)
- *2012 Annual LUC Monitoring Checklists for IRP Site 5, Andersen AFB, Guam* (PCR, 2012b)
- *2013 Annual LUC Monitoring Checklists for IRP Site 5, Andersen AFB, Guam* (PCR, 2013c)
- *Final Spring 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (PCR, 2011a)
- *Final Fall 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (PCR, 2012a)
- *Final Spring 2012 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (PCR, 2012d)
- *Final Fall 2012 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (PCR, 2013a)
- *Final Spring 2013 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (PCR, 2013b)
- *Draft Fall 2013 Groundwater Monitoring Report for Andersen Air Force Base, Guam.* (PCR, 2014a)
- *Land Use Control Management Plan for Sites 2, 5, 6, 8, 9, 12, 20, 35. Andersen Air Force Base, Guam.* September (PCR, 2012c)
- USEPA Region 9 PRG Table. (USEPA, 2004)
- USEPA Regional Screening Level (RSL) Summary Table. (USEPA, 2013)

Numerous other documents have been cited in the preparation of this five-year review, and are found in the References section.

2.6.4 Data Review

Since the ROD was issued in 2007, eleven (11) rounds of the Long Term Groundwater Monitoring (LTGM) Program for the Main Base OU have been completed. There are no monitoring wells at Site 5; however, monitoring well IRP-5 and production wells Y-15 and USGS-128 are located within a 1.0-mile radius of the site. These wells were removed from the LTGM Program in 2003 as COCs were never detected at or above Safe Drinking Water Act maximum contaminant levels.

No other sampling or environmental data have been collected for this site.

2.6.5 Site Inspection

Annual LUC site inspections have been conducted each year at Site 5 since the establishment of LUCs in 2007. The purpose of the inspections is to assess the protectiveness of the LUCs. LUCs at this site include prohibitions on excavation activities and disturbance of the soil. No evidence of human activities that violate the LUCs has been observed during site inspections. The most recent site inspection for Site 5 was conducted on June 13, 2013.

The Annual LUC Compliance Certificates and photograph logs for this site are included as Appendix 2.

2.6.6 Interviews

As part of the Five-Year Installation Review, interviews were conducted with various parties. Mrs. Carmen Denton, Lab Services Administrator for Guam Waterworks Authority was interviewed on March 22, 2012. Mr. Michael Cruz representative from GEPA was interviewed on March 27, 2012. Overall the interviewees were pleased with the status of the Site 5 LUCs and the responsiveness of the Installation Restoration (IR) program and staff. No significant problems regarding the site were identified during these interviews.

Most interviewees made recommendations that RAB meetings should be held more regularly, citing that planned quarterly meetings are often cancelled. The regularity of these meetings assures communication between the Navy and the community. Additionally, interviewees believe that the program would improve with more community involvement at the RAB meetings, and active recruiting should occur to increase RAB participation.

Mr. Cruz from GEPA stated that he would like to see the Air Force IR personnel conduct more frequent site visits to all IR sites to assure that LUCs are being maintained.

The content of the interviews was recorded and presented in Appendix 1.

2.7 Technical Assessment

These technical assessment questions have been presented by USEPA in the "Comprehensive Five-Year Review Guidance" report of June 2001, and are considered a part of the review process that should be addressed.

2.7.1 Question A: Is the remedy functioning as intended by the decision documents?

Review of the final ROD, other relevant documents, applicable or relevant and appropriate requirements (ARARs), risk assumptions, annual LUC site inspections, and five-year review site reconnaissance results indicate that remedy, although not fully implemented, is functioning as intended.

2.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy site selection still valid?

There have been no significant changes in the assumptions, toxicity data, clean up levels, assessment methodologies, or RAOs for this site that would require the risk assessment models to be redone or that would call into question the protectiveness of the remedy for this site.

The 2013 residential soil RSLs for antimony, copper, lead and manganese (31, 3100, 400, 1800 mg/kg respectively) are the same as the 2004 Residential PRG values that were used to select the remedy for this site. The cleanup goals for this site were set to either the 2004 PRG or the background threshold value (BTV), whichever value was higher.

No new contaminants have been identified for this site.

Table 2-2: Site 5 PRG/RSL Summary

	2004 PRGs Residential mg/kg	2013 RSL Residential mg/kg	Cleanup Goal mg/kg
Antimony	31	31	63 (BTV)
Copper	3,100	3,100	3,100
Lead	400	400	400
Manganese	1,800	1,800	5,500 (BTV)

2.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new ecological or human risks have been identified, and no weather-related or other event has affected the protectiveness of the remedy. The LUCs are in place and continue to prevent exposure. No other information has been found that would call into question the protectiveness of the remedy.

No data from the Long Term Management Program has been found that would call into question the protectiveness of the remedy at this site.

2.7.4 Technical Assessment Summary

The review of documents, ARARs, and risk assumptions and the site inspection results indicate that the selected remedy, although not fully implemented, is functioning as intended.

No change has occurred in the toxicity factors for the COPCs that were used in the risk assessments, and no significant change has occurred to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

2.8 Issues

The following LUCs, specified in the ROD, have not been implemented and are planned for 2014

- In the Base General Plan, identify the designated LUC area as prohibited from further residential development. (The LUCs will be implemented through amendments to the BGP that will effectively act as deed restrictions.)
- Survey and Mark LUC Boundaries and Post Signage: Site 5 will require a survey to locate and install permanent markers to mark the corners of the designated LUC areas. Signs will be posted around the perimeter of the site.
- Notify residents and provide signage to inform residents and utility workers that excavation is prohibited at the site.

2.9 Recommendations and Follow-up Actions

Implement those LUCs that have not yet been implemented.

2.10 Protectiveness Statement

The remedy at Site 5 is protective of human health and the environment in the short term. It will be fully protective after the LUCs have been fully implemented. Exposure pathways that could result in unacceptable risks due to exposure to, or the ingestion of, contaminated soil are being controlled through the 6-ft (depth) clean soil cover and institutional controls. The continued protectiveness of the remedy is verified through annual LUC site inspections which monitor the site for excavation or uncontrolled removal of soil, and unauthorized development or new structures. Full implementation of the LUCs is required for this site to be in compliance.

2.11 Next Review

The next Installation Review is due five years from the USEPA's approval of this review.

2.12 Site 5 Annual LUC Compliance Inspection Reports

See Appendix 2 for LUC Compliance Inspection Reports for Sites 5, 6, 8 and 12 for years 2011 to 2013

3. Site 6

3.1 Introduction

The purpose of this Five-Year Review report is to determine whether the remedy at Site 6 (Landfill 8) Andersen Air Force Base (Figures 2-1 & 2-2) is protective of human health and the environment by reducing the potential for exposure to low levels of chemicals in soil at the site. This Five-Year Review report is required due to contamination above levels, which would allow for unrestricted land use and unlimited exposure.

This Five-Year Review report identifies issues found during this review, if any, and lists recommendations to address them.

This site's LUCs are presented below:

LUC Requirement/Description	LUC Interval	Starting Date
Survey and Mark LUC Boundaries	Initially	Planned for 2014
Install protective signage	Initially	October 2011
The BGP will be amended annually to identify the designated LUC area(s) as restricted from transfer/lease and residential development indefinitely as long as site conditions are not suitable for unrestricted use and unlimited exposure	Annually	Planned for 2014
Update GeoBase to include areas to be managed under LUCs	Annually	Planned for 2014
Prevent the future development and/or use of the designated property and vicinity for residential housing, elementary and secondary schools, child care facilities and playgrounds, or any other activities that would result in children being exposed to the soils at the site.	Initially	December 2007
Perform annual site inspection and prepare Compliance Summary Report	Annually	November 2008
Require Dig and Construction Permits prior to intrusive activities within the LUC area.	Initially	December 2007
Perform formal 5-year reviews as required by CERCLA. The 5-year reviews will continue as long as COCs remain at levels above those suitable for unrestricted use of the site.	Once Every Five Years	2014



Project: Five-Year Installation Review Report

Description: Location of Site 6

Figure
3-1



Project: Five-Year Installation Review Report
Description: LUC Site Diagram of Site 6

Figure 3-2

3.2 Site Chronology

Table 3-1: Chronology of Site Events for Site 6

Event	Date
Site Construction	1946
Disposal of aliphatic and liquid wastes	1946-1949
Phase 1 Records Search	1985
RCRA Facility Assessment	1986
Initial Community Relations Plan	1993
Federal Facility Agreement (FFA)	1993 Mar
Updated Community Relations Plan	1998
Restoration Advisory Board (RAB)	1995
Final Records Search	1996
Engineering Evaluation/Cost Analysis for site	2000
NTCRA (partial clean up)	2000 Nov
Final Management Action Plan	2001 Dec
RI/FS (Initial field work)	2006 (2002 Feb)
HHRA and SRA (in Remedial Investigation (RI))	2006
Public meeting to present Proposed Plan	2006
ROD	2007 Aug
Annual LUC Inspection	2008 - 2010
Contractor Laydown/Storage Yard Constructed at Site	2010
Annual LUC Inspection	2011-2013
LUCMP	2012 Sep
Annual LUC Inspection	2013
5 Year Review Report: Initial	2014

3.3 Background

Site 6 (Landfill 8) is situated in the western portion of the Main Base, and covers an area of approximately 8 acres (Figure 2-2). It is located adjacent to Explosive Ordnance Disposal (EOD) Building 9001, is approximately 1,000 feet to the southwest of Area 9100 and is bordered on the east by a paved road. Site 6 is open, grassy, and relatively flat with elevations ranging from 470 to 482 feet above msl. Site 6 is accessible from paved roads to the Munitions Storage Area (MSA) and a gated road to the Base Landfill. The perimeter of the site is bordered by limestone forest. The nearest residential housing area is the village of Yigo, located approximately 1.3 miles south of the Main Base boundary.

Site 6 is currently being used by a government contractor as a laydown/storage yard. The fenced area used for the laydown/storage yard is partially located within the LUC boundary. No other permanent surface or underground structures/cables/pipelines are located within the designated LUC area.

3.3.1 History of Contamination

Based on historical records research and interviews, Site 6 was used as a trench-and-fill operation for burial of asphaltic waste material and waste liquids from 1946 to 1949 (ESE,

1985). Based on earlier site evaluations, Site 6 was estimated to contain approximately 700 drums. From 1998 to 2000, the vast majority of drums, asphalt debris, and asphalt-contaminated soil were removed from the surface at Site 6. Approximately 2,000 empty drums and 7,850 cy of asphalt debris, including drums containing asphalt and asphalt-contaminated soil, were removed from the site.

Site 6 was used as a trench-and-fill operation for burial of asphaltic waste material and waste liquids from 1946 to 1949 (ESE, 1985). Site 6 was estimated to contain approximately 700 drums.

Contaminants of potential concern include:

- Surface soil COPCs: Based on the analytical results, aluminum, cadmium, chromium, thallium, benzo(a)pyrene, and dibenz(a,h)anthracene exceeded their respective residential PROs and BTVs.

- Subsurface soil CPOCs: Based on the analytical results, aluminum, antimony, and chromium exceeded their respective residential PROs and BTVs.

3.3.2 Initial Response

Removal activities in November 2000 involved excavating empty drums, asphalt-containing drums, asphalt-coated soil, and other debris and their removal from Site 6 (IT, 2001) and storing these items at a staging area near Site 1. Approximately 2,000 empty drums and 7,850 cy of asphalt debris, including drums containing asphalt and asphalt-contaminated soil, were removed from the site (OHM, 2001).

During the RI fieldwork (February-March 2002), a site reconnaissance and detailed site inventory (DSI) were conducted to accurately define the environmental setting and boundaries of the site, including identification of potentially hazardous wastes. In addition to the DSI, an ecological (flora and fauna) survey was performed to identify potential ecological receptors and exposure pathways.

Prior to the 2002 field investigation, Site 6 was evaluated in three environmental investigations as part of the Main Base OU as follows:

- *IRP Phase I Records Search*. (ESE, 1985)
- *Resource Conservation and Recovery Act Facility Assessment (RFA) Report*. SAIC, 1986)
- *IRP Phase II Confirmation/Quantification, Stage I*. (Battelle, 1989)

Site 6 was included in the IRP Phase I Records Search, but was not scored according to Hazard Assessment Rating Methodology (HARM) because of “minimal potential for contamination or hazardous leachate formation” (ESE, 1985). Based on the decision process outlined in the IRP Phase I Records Search, Site 6 was not recommended for further environmental investigation (ESE, 1985). Aerial photographs dated 1946, 1959, 1984, and 1993 show the site as cleared. No potential disposal activities were indicated in the photographs. An aerial photograph of the site taken in 1959 distinctly shows cleared areas trending east west; however, there was no other indication of activity at the site. There were no aerial photographs taken of the site between 1960 and 1983. Revegetation of the site is evident

on aerial photographs taken between 1984 and 1993. According to the 1986 RFA site visit, “up to 20 rusted and leaking drums were visible on the ground surface” (SAIC, 1986). Furthermore, according to the IRP Phase II, Stage 1 Final Report, most of the site was covered with asphalt drums and asphalt debris, and in some areas animal remains were found in depressions located down gradient from deteriorated drums (Battelle, 1989). During the 1989 IRP Phase II, Stage 1 investigation at Site 6, two surface soil samples were collected from areas coated with the asphaltic materials and one surface soil sample and duplicate sample were collected from background areas. These samples were analyzed for VOCs, SVOCs, pesticides, and polychlorinated biphenyls (PCBs). Only trace concentrations of SVOCs were detected in samples collected from areas impacted by the asphaltic material (SAIC, 1990). The 1989 IRP Phase II, Stage 1 sampling and analyses were not performed in accordance with the following approved Base-wide plans and procedures for Andersen AFB:

- Base-wide Health and Safety Plan (EA, 1996a)
- Standard Operating Procedures (EA, 1996b)
- Quality Assurance Project Plan (EA, 1999)
- OU5 Sampling and Analysis Plan (ICF, 1995)
- OU6 Work Plan (ICF, 1994a).

As a result, the 1989 IRP Phase II, Stage 1 sample results are not valid for use in the HHRA or ERA under the IRP, and were not presented in the RI/FS. In November 2000, the empty drums, asphalt-containing drums, asphalt-coated soil, and other debris were excavated and removed from Site 6 (IT, 2001) and stored at a staging area near Site 1. Between November 1998 and November 2000, the following removal actions were completed:

- The site was permitted, cleared, grubbed, and the debris was consolidated.
- Approximately 850 drums containing asphalt contaminated with soil and approximately 2,800 cy of loose asphalt-contaminated soil and other debris were removed from Site 6 and transported to a temporary storage area located at Site 35 on Andersen AFB.
- Approximately 2,000 empty drums and metal debris were removed from Site 6 and transported to the Andersen AFB consolidation unit (CU) for disposal.
- Approximately 5,000 cy of asphalt contaminated with soil and other debris were removed from Site 6 and transported to a temporary storage area located at Site 35 (IT, 2001). Following this, the asphalt was reprocessed, drummed, and donated to the Government of Guam to be put to beneficial use.

Confirmation surface soil samples were collected and analyzed after the asphalt and debris were removed (IT, 2001). Based on the analytical results, the USAF decided to conduct a RI to further evaluate Site 6. The purpose of the RI was to identify and characterize COPCs at the site and evaluate risks to human health and the environment.

3.3.3 Basis for Taking Action

Site conditions pose no unacceptable risks to ecological receptors or to occasional users/trespassers. Portions of the site pose potential unacceptable cancer and non-cancer risks to resident adults and children exposed to surface and subsurface soil.

Potential receptors at the site include workers at the current laydown yard and occasional users/trespassers. This includes hunters or trespassers who may walk through the area, as well as maintenance workers who may work at the site on a limited basis. There is limited

hunting of deer and wild pigs in this area of Andersen AFB. Although adults and children who consume deer and pig meat are also considered receptors at the site, the risks associated with ingestion of deer and wild pig meat have been addressed on a Base-wide basis and have been presented in a separate report (EA, 1995). Due to the proximity to the MSA and Base Landfill Complex there are no plans to develop this site for residential use in the future.

The media of concern identified at the site are surface soil, subsurface soil, and air exposures that could result from dispersion of surface and subsurface soil into air. The exposure pathways that are considered for the unlikely future resident adult and child scenario are incidental ingestion of and dermal exposures to surface soil. It is assumed that residents could be exposed to subsurface soil, which could be disturbed during digging or excavation activities and brought to the surface. Therefore, as a conservative measure, residents were also evaluated for incidental ingestion of, dermal contact with, and inhalation of subsurface soil particles. The exposure pathways that were considered for current and future occasional users/trespassers were incidental ingestion of, dermal contact with, and inhalation of airborne particulates of surface soil.

Contaminants of concern include:

- Surface soil COCs: Based on the analytical results, aluminum, cadmium, chromium, thallium, benzo(a)pyrene, and dibenz(a,h)anthracene exceeded their respective residential PROs and BTVs.
- Subsurface soil COCs: Based on the analytical results, aluminum, antimony, and chromium exceeded their respective residential PROs and BTV s.

3.4 Remedial actions

3.4.1 Remedy Selection

The selected remedy does not include the removal of any additional contaminated soil. Although there had been excavations and removal of items from this site, the soil still contains contaminants. This will result in contaminated surface and subsurface soil remaining onsite at concentrations that could pose potential unacceptable risks to future resident adults and children. The residual concentrations would not pose unacceptable risks to ecological receptors or occasional users/trespassers and other human receptors that are exposed to site soils on an infrequent basis. As such the LUCs shall control direct human (resident adults and children) exposure to contaminated surface and subsurface soils within the area defined in Figure 2-2 and prevent the future development and/or use of the designated property and vicinity for residential housing, elementary and secondary schools, child care facilities and playgrounds, or any other activities that would result in children being exposed to the soils at the site.

Site access is limited to persons with access to the Main Base. The site is located within an industrial area of the Base that is not generally accessed. In addition the site is restricted from future residential development due to its proximity to the active Base Sanitary Landfill (BSL) and the MSA. There is no fencing or other engineering controls (ECs) currently at the site and none would be required as there are no risks to occasional users/trespassers or ecological receptors. The land will be restricted from future residential development through implementation of LUCs that will be amended into the BGP that will effectively act as deed restrictions.

3.4.2 Remedy Implementation

Site 6 is located on the active portion of the Main Base and there are no plans for the Navy to lease or transfer the property. In the event the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. In the event of a transfer of the property the Navy will provide the USEPA and GEPA with six (6) months prior notice to the transaction so that they can be involved in the process to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. In addition the Navy has agreed to provide the USEPA and GEPA with similar notice, in the event of a federal-to-federal transfer of property. Upon completion of the transfer the Navy shall provide a copy of the executed deed or transfer document(s) to the USEPA and GEPA.

In general, no intrusive activities shall occur within the designated LUC area at Site 6. All dig and construction permits relevant to Site 6 will be documented in the LUCMP for Site 6. If intrusive activities were necessary within the designated LUC area they would require prior approval of 36 CES/CEVR. If intrusive activities were conducted within the designated LUC area, the work would require an approved health and safety plan and procedures for the proper handling and disposal of displaced wastes and/or soils. This requirement shall be subject to an annual review and will remain in effect indefinitely as long as COCs in surface and subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

In accordance with the LUCMP Signs indicating that Site 6 is an IRP Site and directing people to call 36 CES/CEVR before entry have been installed at Site 6. Signage shall be monitored annually as part of the operations and maintenance activities described herein. Fencing of the designated LUC area is not required.

3.5 Progress Since the Last Five –Year Review

This is the first five-year review for this site.

3.6 Five-Year Review Process

3.6.1 Administrative Components

Andersen AFB has conducted a five-year review of the remedial actions implemented at Site 6. This review was conducted from February 2012 to September 2014. This report documents the results of the review. The review was conducted by PCR Environmental, Inc. under Contract Task Order 009 of Contract N62742-09-D-1953.

3.6.2 Community Notification and Involvement

Agency and public participation in the decision process for environmental activities has been encouraged throughout the site closure processes. Community and regulatory agencies have provided regulatory input through periodic RAB meetings. These meetings will continue until the CERCLA processes are complete. Information concerning the five-year review process and its findings will be presented to the public during these routine project team meetings. The last RAB meeting was held in September 2012; however, Site 6 was not discussed during this meeting.

3.6.3 Document Review

This five-year review consisted of a review of relevant documents including the Land Use Control Management Plan for Andersen AFB, annual LUC inspection reports, and groundwater monitoring data. The 2007 ROD was reviewed for site history and remedial actions. The ROD was also reviewed, along with applicable ARARs, such as the 2004 EPA PRGs and 2013 EPA RSLs, for the discussion of exposure assumptions, toxicity data, cleanup levels and remedial action objectives for the site. A list of these documents is presented below:

- *Final Record of Decision for Sites 6, 9 and 12, Main Base Operable Unit, Andersen Air Force Base, Guam. August. (EA, 2007c)*
- *Final Spring 2008 Groundwater Monitoring Report for Andersen Air Force Base, Guam (EA, 2008)*
- *Final Fall 2008 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2009a)*
- *Final Spring 2009 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2009b)*
- *Final Fall 2009 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2010a)*
- *Final Spring 2010 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2010b)*
- *Final Spring 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2011a)*
- *2011 Annual LUC Monitoring Checklists for IRP Site 6, Andersen AFB, Guam (PCR, 2011b)*
- *2012 Annual LUC Monitoring Checklists for IRP Site 6, Andersen AFB, Guam (PCR, 2012b)*
- *2013 Annual LUC Monitoring Checklists for IRP Site 6, Andersen AFB, Guam (PCR, 2013c)*
- *Final Spring 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2011a)*
- *Final Fall 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2012a)*
- *Final Spring 2012 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2012d)*
- *Final Fall 2012 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2013a)*
- *Final Spring 2013 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2013b)*
- *Draft Fall 2013 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2014a)*
- *Land Use Control Management Plan for Sites 2, 5, 6, 8, 9, 12, 20, 35. Andersen Air Force Base, Guam. September (PCR, 2012c)*
- USEPA Region 9 PRG Table. (USEPA, 2004)
- USEPA Regional Screening Level (RSL) Summary Table. (USEPA, 2013)

Numerous other documents have been cited in the preparation of this five-year review, and are found in the References section.

3.6.4 Data Review

Since the ROD was issued in 2007, eleven (11) rounds of the LTGM Program for the Main Base OU have been completed. Monitoring well IRP-48 is located within a 0.5-mile radius of Site 6. Groundwater samples have been collected from this monitoring well for thirty-three (33) rounds since October 1996 and have been sampled for VOCs, PAHs, metals, and chloride. Target analytes have never been detected above the SDWA MCLs in groundwater samples collected from this well.

No other sampling or environmental data have been collected for this site.

3.6.5 Site Inspection

Annual LUC site inspections have been conducted each year at Site 6 since the establishment of LUCs in 2007. The purpose of the inspections is to assess the protectiveness of the LUCs. LUCs at this site include warning signage, prohibitions on excavation activities and disturbance of the soil. The most recent site inspection for Site 6 was conducted on June 13, 2013.

Since 2010, there have been multiple unpermitted uses of the site as a lay down yard for construction contractors. In the development of the site as a laydown yard, contaminated soil was spread out over the site.

The Annual LUC Compliance Certificates and photograph logs for this site are included as Appendix 2.

3.6.6 Interviews

As part of the Five-Year Installation Review, interviews were conducted with various parties. Mrs. Carmen Denton, Lab Services Administrator for Guam Waterworks Authority was interviewed on March 22, 2012. Mr. Michael Cruz representative from GEPA was interviewed on March 27, 2012. Overall the interviewees were pleased with the status of the Site 6 LUCs and the responsiveness of the IR program and staff. No significant problems regarding the site were identified during these interviews.

Most interviewees made recommendations that RAB meetings should be held more regularly, citing that planned quarterly meetings are often cancelled. The regularity of these meetings assures communication between the Navy and the community. Additionally, interviewees believe that the program would improve with more community involvement at the RAB meetings, and active recruiting should occur to increase RAB participation.

Mr. Cruz from GEPA stated that he would like to see the Air Force IR personnel conduct more frequent site visits to all IR sites to assure that LUCs are being maintained.

The content of the interviews was recorded and presented in Appendix 1.

3.7 Technical Assessment

These technical assessment questions have been presented by USEPA in the "Comprehensive Five-Year Review Guidance" report of June 2001, and are considered a part of the review process that should be addressed.

3.7.1 Question A: Is the remedy functioning as intended by the decision documents?

Review of the final ROD, other relevant documents, ARARs, risk assumptions, annual LUC site inspections, and five-year review site reconnaissance results indicate that selected remedies are not functioning as intended.

3.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy site selection still valid?

Aluminum and Antimony: There have been no significant changes in the assumptions, toxicity data, clean up levels, assessment methodologies, or RAOs for this site that would require the risk assessment models to be redone or that would call into question the protectiveness of the remedy for this site.

The 2013 residential soil RSL for aluminum (77,000 mg/kg) is less stringent than the 2004 Residential PRG value (76,000) that was used to select the remedy for this site. The 2013 residential soil RSL for antimony (31 mg/kg) is the same as the 2004 Residential PRG value that was used to select the remedy for this site. The cleanup goals for this site were set to the BTVs, as these values exceeded the 2004 PRGs.

Chromium: The 2004 residential PRG for chromium (Cr) was 210 mg/kg of “total chromium”; the industrial PRG was 450 mg/kg. Since 2009, EPA has discontinued the use of total chromium, and has separated the RSLs for chromium into Cr III and Cr VI. EPA estimates these valences to occur in nature at a ration of 1:6 Cr VI:Cr III. The 2013 residential RSL for Cr VI is 0.29 mg/kg, the industrial RSL is 5.6 mg/kg. The cleanup goal established for total chromium at this site (based on the BTV) was 1080 mg/kg. Using the EPA ratio of 1:6, the presence of Cr VI at the site is approximately 154 mg/kg. Although this is well above the 2013 RSLs, since the background level of Cr VI at this site is approximately 154 mg/kg, it is not possible to clean up the site below this level, and thus the cleanup goal for Cr VI is effectively 154 mg/kg.

No new contaminants have been identified for this site.

Table 3-2: Site 6 PRG/RSL Summary

	2004 PRGs Residential mg/kg	2013 RSL Residential mg/kg	Cleanup Goal mg/kg
Aluminum	76,000	77,000	173,500 (BTV)
Antimony	31	31	63 (BTV)
Chromium	210	(see chromium discussion above)	1080 (BTV)

3.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new ecological or human risks have been identified, and no weather-related or other event has affected the protectiveness of the remedy.

Results of this five-year inspection indicate that the LUCs for this site have remained effective and protective of human health and the environment. Although contaminated soil was moved from a restricted portion of the site to a unrestricted portion of the site, the use of the entire area as a construction laydown yard is compatible with established LUCs which allow for industrial use. No other information has been found that would call into question the protectiveness of the remedy, other than these intrusions and soil disturbances at the site.

No data from the LTGM Program has been found that would call into question the protectiveness of the remedy at this site.

3.7.4 Technical Assessment Summary

The review of documents, ARARs, and risk assumptions and the site inspection results indicate that the selected remedy is not functioning as intended for this site, as stated in the above section.

No change has occurred in the toxicity factors for the COPCs that were used in the risk assessments, and no significant change has occurred to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

3.8 Issues

Results of this five-year inspection indicate that the LUCs for this site have not remained effective and protective of human health and the environment. There is evidence of uncontrolled removal of soil from the site, and unauthorized development at the site.

The following LUCs, specified in the ROD, have not been implemented and are planned for 2014

- Survey and Mark LUC Boundaries
- The BGP will be amended annually to identify the designated LUC area(s) as restricted from transfer/lease and residential development indefinitely as long as site conditions are not suitable for unrestricted use and unlimited exposure
- Update GeoBase to include areas to be managed under LUCs

3.9 Recommendations and Follow-up Actions

Since there have been intrusions, unauthorized development, and removal of contaminated soils from this site, Andersen AFB will need to review their LUC protection procedures, since these procedures were not followed for this site. An investigation is required to determine the cause and provide recommendations for corrective actions

Following is an excerpt from the Site 6 section of the 2012 LUCMP entitled "Zoning and Notations in Base General Plan (BGP)" which could be used as a guide to the investigation:

AFI 32-1021 (Planning and Programming Military Construction Projects) requires installations to comply with their BGP to ensure that there are no conflicts with land-use constraints stemming from the LUCs of the Environmental Restoration Program (ERP) that would impact facility planning and construction. Any requests for residential use or invasive activities (i.e. construction) through excavation permits, such as AF Form 103,

or the construction review process, as per AFI 32-1001 (Operations Management), will be denied, unless the procedures for proposed land use changes described in the approved ROD, and amended to the BGP, are followed. ... The BCE will not approve dig permits for activities inconsistent with the LUCs as amended to the BGP and no changes in the type of land use designated in the ROD shall be implemented within the designated LUC area without the prior knowledge and concurrence of the USAF, USEPA and Guam EPA.

Because the site conditions have changed, a follow up assessment should be performed to determine the types and levels of COCs remaining at the site. Base on the results of this assessment, the ROD may need to be amended.

3.10 Protectiveness Statement

The remedy at Site 6 is protective of human health and the environment in the short term. Exposure pathways that could result in unacceptable risks are being controlled. However, portions of the LUCs at this site have not been followed and an investigation is required to determine the cause and provide recommendations for corrective actions. Although contaminated soil was moved from a restricted portion of the site to a unrestricted portion of the site, the use of the entire area as a construction laydown yard is compatible with established LUCs which allow for industrial use.

3.11 Next Review

The next Installation Review is due five years from the USEPA's approval of this review.

3.12 Site 6 Annual LUC Compliance Inspection Reports

See Appendix 2 for LUC Compliance Inspection Reports for Sites 5, 6, 8 and 12 for years 2011 to 2013

4. Site 8

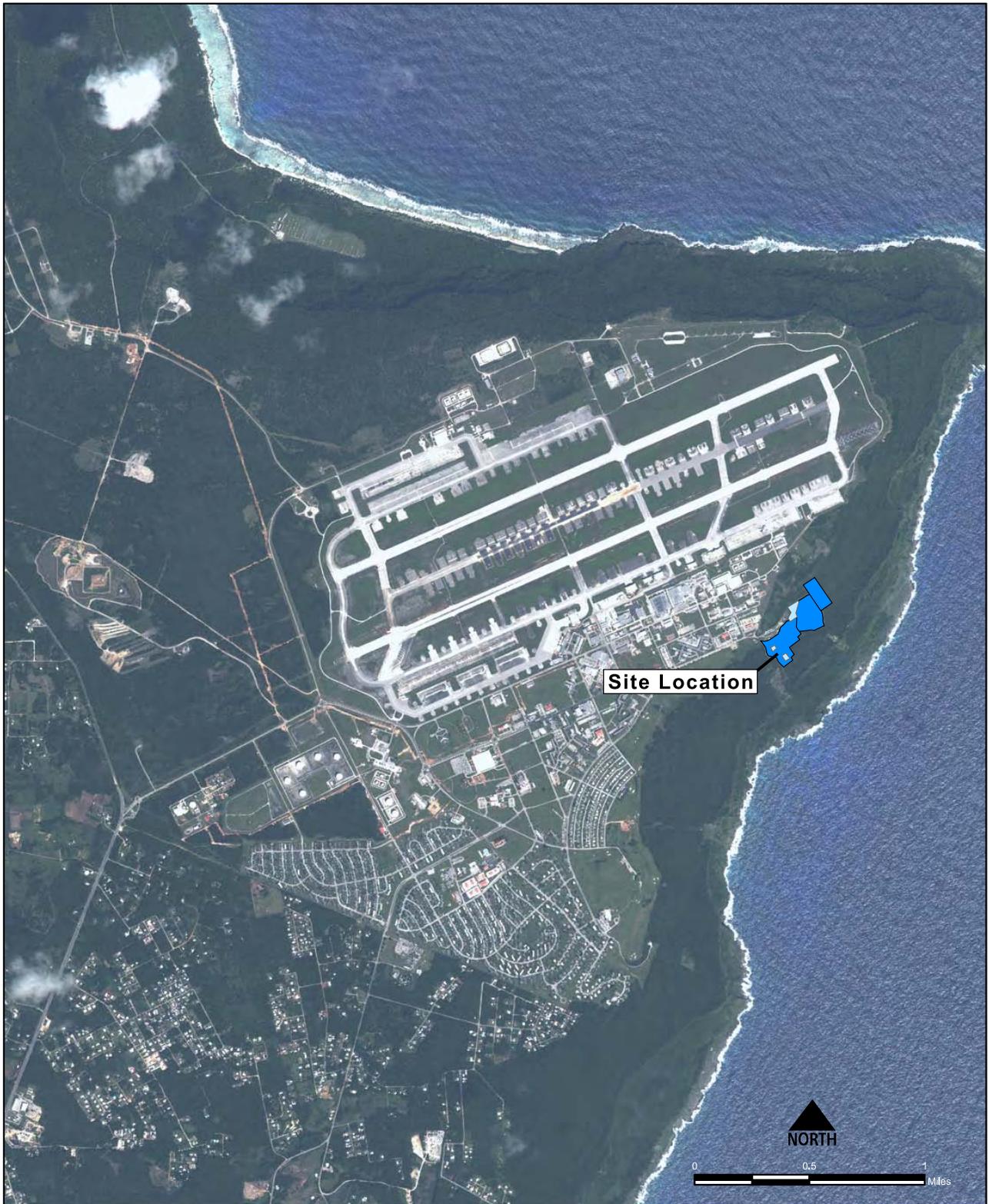
4.1 Introduction

The purpose of this Five-Year Review report is to determine whether the remedy at Site 8, Andersen AFB, Guam (Figures 3-1 & 3-2) is protective of human health and the environment by reducing the potential for exposure to low levels of chemicals in soil at the site. This Five-Year Review report is required due to contamination above levels, which would allow for unrestricted land use and unlimited exposure.

This Five-Year Review report identifies issues found during this review, if any, and lists recommendations to address them.

This site's LUCs are presented below:

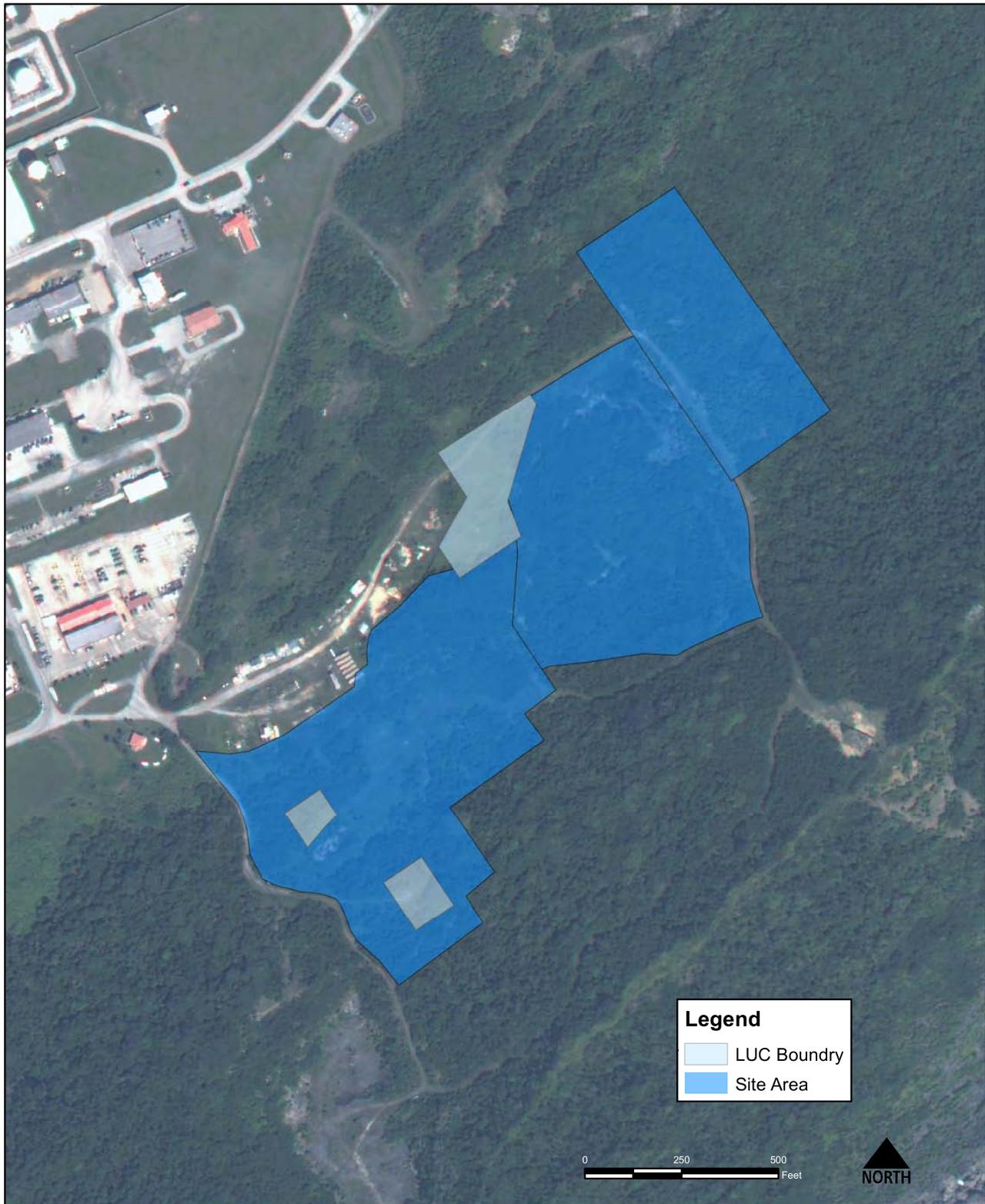
LUC Requirement/Description	LUC Interval	Starting Date
Prohibit the redevelopment of Site 8 (Landfill 10C area; specifically prohibition of residential use or use that would result in exposures to children) without prior approvals from the USEPA and Guam EPA.	Initially	September 2007
In the Base General Plan, identify the designated LUC area as prohibited from future residential development. (The LUCs will be implemented through amendments to the BGP that will effectively act as deed restrictions.)	Annually	Planned for 2014
Survey and Mark LUC Boundaries. Perform survey to locate and install permanent markers to mark the corners of the designated LUC areas. Signs will be posted around the perimeter of the site	Initially	Planned for 2014
Limit access to the site through the installation and maintenance of barriers (i.e., fencing).	Annually & Event Driven	September 2007
Post signage indicating that the designated LUC area poses a potential health risk, and that individuals should not enter the restricted area without prior consultation and consent from the USAF and the proper training.	Initially	September 2007
Limit and control any future intrusive activities at the site (e.g., worker requirements, soil management, waste disposal).	Initially	September 2007
Require Dig and Construction Permits prior to intrusive activities within the LUC area.	Initially	September 2007
Perform annual site inspection and prepare Compliance Summary Report	Annually	September 2008
Perform formal 5-year reviews as required by CERCLA. The 5-year reviews will continue as long as COCs remain at levels above those suitable for unrestricted use of the site.	Once Every Five Years	2014



Project: Five-Year Installation Review Report

Description: Location of Site 8

Figure
4-1



Project: Five-Year Installation Review Report

Description: LUC Site Diagram of Site 8

Figure
4-2

4.2 Site Chronology

Table 4-1: Chronology of Site Events for Site 8

Event	Date
Site Construction and use	1950s
Phase 1 Records Search	1985
RCRA Facility Assessment	1986
Initial Interviews	1992
Initial Community Relations Plan	1993
Federal Facility Agreement (FFA)	1993 Mar
Updated Community Relations Plan	1998
Restoration Advisory Board (RAB)	1995
Final Records Search	1996
Initial RI (partial)	1998-2000
Engineering Evaluation/Cost Analysis for site (amended)	2000 (2002)
Final Management Action Plan	2001 Dec
Interim Action	2004
Site closed (fence installed)	2004
RVR – Remediation Verification Report (Interim Remedial Action)	2004
RI/FS	2007
ROD	2007 Aug
HHRA and SRA (in RI)	2007
Public meeting to present Proposed Plan	2007
Annual LUC Inspections	2008 - 2013
LUCMP	2012 Sep
Annual LUC Inspection	2013
5 Year Review Report: Initial	2014

4.3 Background

Site 8 is located on approximately 27 acres along the eastern edge of the Main Base of Andersen AFB (Figures 3-1 and 3-2), and is comprised of three landfill areas (Landfills 10-A, 10-B, and 10-C) that trend northeast-southwest. In general, the site topography slopes inward towards the quarry (Landfill 10-A) and to a low area near monitoring well USGS-150. No buildings remain on the property and the forest habitat has been reclaiming the land since USAF operations stopped in this area. Ground cover currently consists of sparse to heavy undergrowth beneath a canopy of taller emergent trees. The site includes unpaved roads that traverse the site, an abandoned quarry (borrow pit), debris on the walls of the former quarry, and three concrete pads that were foundations of former building structures.

Andersen AFB future land reuse plans designate Site 8 for open space and will restrict residential housing and recreational facilities from the site. Therefore, it is highly unlikely that residential exposures would occur at the site in the future.

4.3.1 History of Contamination

No written documents were discovered pertaining to the wastes disposed of at Landfills 10-A,

10-B, and 10-C; however, a BCE drawing indicated that several buildings were located in the vicinity of Landfills 10-A, 10-B, and 10-C. These structures were designated as "T" (temporary) buildings/structures that included an office building, aggregate plant, screening plant, and a water pump house. Andersen AFB Real Property records and September 1958 photographs confirm the existence of a quarry/aggregate plant and concrete batching facility on Landfills 10-A and 10-C. The quarry was formerly known as the Andersen Quarry No.2. These records also indicate that the facilities, designated as structure T-1459 (Rock Crusher Plant and associated conveyor system), were demolished in June 1963. Also, a small arms range was located 1,600 feet southeast of the quarry/aggregate plant (ICF, 1996).

One document entitled "Transfer of Construction", dated 10 August 1960, indicates a groundwater production well located next to the Andersen Quarry No.2, adjacent to the Aggregate Plant. The well and pump house was formerly designated as structure T -1460. The pump house has been removed and the well is now designated as monitoring well USGS-150. Landfill 10-A is situated at the former Andersen Quarry No. 2, while the aggregate plant was situated in the area known as the "Processing Area" in Landfill 10-C. Based on the IRP Phase I Records Search (ESE, 1985), Landfill 10-A was active in the early- to mid 1950s and was used for the disposal of scrap metal, empty 55-gallon drums, refuse, construction debris, asphalt wastes, sanitary waste, some occasional solvents, and petroleum, oil, and lubricants. The disposal methods of the period consisted of cliff dumping and area land filling (ESE, 1985). Landfill 10-B was used for the disposal of asphalt materials, construction debris, and empty 55-gallon drums. Landfill 10C was used for the disposal of sanitary waste and small quantities of asphalt waste.

4.3.2 Initial Response

Site 8 was evaluated in the following eight environmental reports:

- *Installation Restoration Program Phase I: Records Search, Andersen Air Force Base, Guam.* (ESE, 1985)
- *RCRA Facility Assessment (RFA) of Solid Waste Management Units at Andersen AFB, Guam, USA.* (SAIC, 1986)
- *Installation Restoration Program, Phase II Confirmatory/Quantification, Stage 1, Andersen AFB, Guam (Phase II, Stage I Report).* (Battelle, 1989)
- *Final Records Search for Andersen Air Force Base.* (ICF, 1996)
- *Final Engineering Evaluation/Cost Analysis (EE/CA) Report for IRP Site 8/Landfills 10A, 10B, and 10C, Andersen Air Force Base, Guam.* (EA, 2000b)
- *Final Record of Decision for Sites 5 and 8 Main Base au, Andersen AFB, Guam 3-1.* (EA, 2007b)
- *Remediation Verification Report, Interim Remedial Action, Installation Restoration Program Site 8/Landfills 10A, 10-B, and 10-C, Main Base OU, Andersen Air Force Base, Guam.* (Shaw, 2004)
- *Remedial Investigation/Feasibility Study for Sites 1, 5, 8, 32, and 33, Main Base*

Operable Unit, Andersen AFB, Guam. (EA, 2007)

According to the IRP Phase I Records Search Report, a HARM score of 65 out of a possible 100 points was given for Landfill 10-A due to the type of debris and the potential for contamination. The HARM score ranks the site relatively high, 4th out of the 20 sites evaluated at that time (ESE, 1985). The 1986 RFA confirmed the potential for contamination (SAIC, 1986). A previous electromagnetic survey indicated that there was no buried metal debris at the site (Battelle, 1989). According to IRP Phase I Records Search, Landfill 10-B was used for the disposal of asphalt materials, construction debris, and empty 55-gallon drums. Although no HARM score was assigned to Landfill 10-B (ESE, 1985), the 1986 RFA stated that there was potential for the release of hazardous materials at Landfill 10-B based on the types of waste and past landfill practices.

According to the IRP Phase I Record Search, Landfill 10C was used for the disposal of sanitary waste and small quantities of asphalt waste. The landfill had a minimal potential for contamination or hazardous leachate formation and was not assigned a HARM rating (ESE, 1985). The 1986 RFA also concluded that no potential release of hazardous materials existed at this site (SAIC, 1986).

In 2000, the USAF completed an EE/CA (EA, 2000b) that included a HHRA and an ERA for the three landfills. Based on the ERA, the USAF identified "negligible potential for risk" and determined that no further ecological evaluation is required at Site 8. Based on the HHRA, the USAF identified no unacceptable human health risks at Landfill 10-A or Landfill 10-B; however, unacceptable human health risks were identified at Landfill 10-C for potential future residents exposed to surface and subsurface soil and for occasional users/trespassers exposed to subsurface soil. During the EE/CA, the USAF's recommended remedial alternative for a CERCLA NTCRA at Site 8 was a *Slope Stabilization and Soil Cover* because of the reasonable overall protection to the current and anticipated receptors and land use at the site (i.e., the occasional user/trespasser receptor). This recommendation also was based on the concern that the unstable slope above the quarry wall would fail and expose subsurface COCs that would pose a risk to human health. In 2002 the USAF issued an EE/CA Amendment (EA, 2002b), which changed the recommended alternative to *ICs* based on changes in the understanding regarding the risk associated with potential slope failure at the site. Therefore, the USAF determined that the remediation alternative for Site 8 needed to address the soil ingestion and dermal contact pathways and not the inhalation pathway. Thus, the *ICs* alternative was considered a viable remedial action for Site 8. The USAF intended the *ICs* alternative to control exposure to potential receptors by restricting access to the site by occasional users/trespassers.

In 2004, the USAF completed an interim action at Site 8 (Shaw, 2004) that included the installation of a 6-foot-high chain-link fence along the boundary between the site and the Lower Civil Engineering Lay down Yard (Site 33 adjacent to the northwestern side of Landfill 10-A) to limit access to the site. This fence also limits subsurface excavation near the northeast end of Site 33 and restricts further disposal of construction debris and sediment at the top of the Site 8 Landfill 10-A (quarry) cliff line from Site 33. The fence is approximately 390 feet long, is constructed of galvanized chain-link fence, and has one 20-foot-wide, double-swing gate. An additional gate (10 feet wide) was installed across the access road to the Landfill 10-C portion of Site 8, near the northwest end of the adjacent Site 33. Signs were posted on both gates to warn workers and/or trespassers not to disturb the subsurface soil.

Seventy-one surface soil samples, including seven duplicate samples, were initially collected from 64 locations in June and September 1998. Forty-four additional surface soil samples, including four duplicate samples, were collected in January 1999 to delineate areas where the initial sample concentrations exceeded USEPA Region 9 residential PRGs and BTV s. Twenty-five additional surface soil samples were collected in February 2000 to further characterize the extent of lead and pesticides in soil. Laboratory analytical results for the surface soil samples are summarized in the RI (EA, 2007a). No soil samples were collected on the steeper quarry wall due to safety concerns for field workers collecting samples. Surface soil samples were collected to characterize and evaluate the risks to human health and the environment. Discrete (grab) surface soil samples were collected at biased and random locations from 0 to 6 inches bgs. The biased samples were typically collected in areas associated with debris or fill material. Most surface soil samples were analyzed for the following parameters:

- SVOCs, USEPA Method SW8270C
- PAHs, USEP A Method SW831 0
- Cyanide, USEP A Method SW9012
- Pesticides/PCBs, USEP A Method SW8081
- Andersen AFB TAL metals, USEPA Method SW60I0B/SW7000 series

Surface soil samples were not analyzed for VOCs because geologic and climatic conditions on Guam induce volatilization and infiltration, thereby limiting the potential presence of VOCs in surface soil samples.

A total of 34 subsurface soils samples, including four duplicate samples, were collected from the bottom of test pit excavations at depths ranging from 2 to 10 feet bgs. Sixteen of the subsurface soil samples, including two of the duplicate samples, were collected from excavations during July and September 1998. During February 2000, 18 additional subsurface soil samples were collected to characterize the extent of pesticides and lead detected in previous samples. The sample results are summarized in the RI (EA, 2007a), and for Landfills 10-A, 10-B, and 10-C, respectively. Subsurface soil samples were collected so that buried waste materials could be characterized and the potential risks to human health and the environment could be evaluated.

Subsurface soil samples were analyzed for the following parameters:

- VOCs, USEPA Method SW8260B
- SVOCs, USEP A Method SW8270C
- PAHs, USEP A Method SW831 0
- Pesticides/PCBs, USEPA Method SW8081
- Cyanide, USEP A Method SW9012
- Total organic carbon, Walkley-Black
- Andersen AFB TAL metals, USEPA Method SW60I0B/SW7000 series

The surface and subsurface soil analytical results were compared to residential and industrial PRGs that were developed by USEP A Region 9 to establish screening criteria for potentially contaminated sites (USEPA, 2004a). As compared to industrial PRGs, the residential PRGs are more conservative regarding the future use of a property. There are no plans to develop the land for residential or commercial use in the foreseeable future.

Because some metal concentrations in soils occur naturally at high concentrations in Guam, BTVs were established (ICF, 1997; Andersen AFB, 2001; EA, 2002a). Six metal BTVs

(aluminum, antimony, arsenic, chromium, manganese, and vanadium) exceed the respective residential PRG. For these metals, the maximum observed concentration was compared to the BTV rather than the residential PRG. If the maximum detected concentration of an analyte exceeded the screening value or BTV, that analyte was then retained as a COPC. Subsequent to determining the COPCs for Site 8, a HHRA and an ERA were conducted to establish the COCs, the RAOs, and the RGs.

Groundwater samples have been collected from three monitoring wells located within 0.5 mile of the site on a semiannual basis. Two of these wells (IRP-5I and USGS-150) are located within Landfill 10C. Monitoring well IRP-42 appears to be located cross gradient from the site. These samples are analyzed for VOCs, SVOCs, PAHs, pesticides/PCBs, and Andersen AFB TAL metals; results were summarized in the RI (EA, 2007a).

4.3.3 Basis for Taking Action

Landfill 10-A

-No unacceptable human health or ecological risks were identified at Site 8 Landfill 10-A.

Landfill 10-B

-No unacceptable human health or ecological risks were identified at Site 8 Landfill 10-B.

Landfill 10-C

-The COCs identified in surface soil at Site 8 Landfill 10-C include dieldrin and lead. The COCs identified in subsurface soil at Site 8 Landfill 10-C include antimony, dieldrin, and lead. These COCs in surface and subsurface soil pose an unacceptable risk to human health (resident adults and children and occasional trespassers and workers). No unacceptable risks to ecological receptors were identified.

Potential receptors at the site include occasional users/trespassers. This includes hunters or trespassers who may walk through the area, as well as maintenance workers who may work at the site on a limited basis. Limited hunting of deer and wild pigs occurs in this area of Andersen AFB. Therefore, adults and children who consume deer and pig meat were also considered receptors at the site. Risks associated with ingestion of deer and wild pig meat has been addressed on a Base-wide basis and is presented in a separate report (EA, 1995). Andersen AFB has prepared a site-specific LUCMP to restrict future residential housing and recreational facilities from the site.

Media of concern identified at the site are surface soil, subsurface soil, air exposures that could result from dispersion of surface and subsurface soil into air, and groundwater. Site 8 is located over one mile down gradient of the nearest production well along the northeastern coast of Guam. Groundwater beneath Site 8 is not potable due to its high salinity and is not a potential drinking water source. In addition, COCs identified at Site 8 are largely immobile inorganic compounds or organic compounds that tend to be strongly sorbed to soils, so it is unlikely that any groundwater impacts would result from the concentrations of COCs present at this location. Therefore, the media of concern identified at the site are surface soil, subsurface soil, and air exposures, which could result from dispersion of surface and subsurface soil into air.

The exposure pathways that are considered for potential future resident adults and children are incidental soil ingestion and dermal exposures to surface soil, and inhalation of dust particulates from surface soil. It is assumed that residents could be exposed to subsurface soil that could be

disturbed during digging or excavation activities and brought to the surface.

Potential future residents are also evaluated for incidental ingestion of and dermal contact with subsurface soil and inhalation of subsurface soil particles. The exposure pathways which are considered for current and future occasional users/trespassers are incidental ingestion of, and dermal contact with, and inhalation of airborne dust particulates of surface soil and subsurface soil (in the event that subsurface soil on the wall of the Landfill 10-A becomes unstable and falls to the bottom of the landfill, where it could be contacted as surface soil).

4.4 Remedial actions

4.4.1 Remedy Selection

Using USEPA guidelines for screening remediation technologies (40 CFR 300.430[e] [7]), numerous remedial technologies for soil were considered for use at Site 8 (EA, 2007a). Many of these were eliminated from further consideration because they were not feasible for the physical and chemical properties of the Site 8 COCs and/or the unique environmental setting. The remaining remedial technologies that were potentially feasible for the mitigation of Site 8 risks were screened according to their effectiveness, implementability, and, to a lesser extent, cost. Remedial technologies retained from the screening process were grouped into remedial alternatives that were further screened based on their effectiveness, implementability, and cost. Based on the remedial technology and alternative screenings, the following three remedial alternatives were retained for detailed analysis:

- NFA
- ICs and ECs
- Slope Stabilization with Soil Cover

The *ICs and ECs* alternative was the selected remedial alternative for Site 8 and will mitigate the identified risks to occasional users/trespassers and hypothetical future on-site residents by controlling site use and preventing residential development of the Site.

The selected remedy does not include the removal of all contaminated soil. This will result in contaminated surface and subsurface soil remaining onsite at concentrations that could pose potential unacceptable risks to future resident adults and children. The residual concentrations would not pose unacceptable risks to ecological receptors or occasional users/trespassers and other human receptors that are exposed to site soils on an infrequent basis. As such the LUCs shall control direct human (resident adults and children) exposure to contaminated surface and subsurface soils within the area defined in Figure 3-2 and prevent the future development and/or use of the designated property and vicinity for residential housing, elementary and secondary schools, child care facilities and playgrounds, or any other activities that would result in children being exposed to the soils at the site.

Site access is limited to persons with access to the Main Base. The land will be restricted from future residential development through implementation of LUCs that will be amended into the BGP that will effectively act as deed restrictions.

The USAF already has completed an interim action to limit unauthorized access to the site. The interim action consisted of installing a 6-foot-high chain-link fence on the northwest side of Landfill 10-A (quarry) and near the northeast boundary of adjacent Site 33, plus the installation of an additional gate across the access road to the Landfill 10C portion of Site 8, near the

northwest end of the adjacent Site 33.

4.4.2 Remedy Implementation

Site 8 is located on the active portion of the Main Base and there are no plans for the Navy to lease or transfer the property. In the event the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. In the event of a transfer of the property the Navy will provide the USEPA and GEPA with six (6) months prior notice to the transaction so that they can be involved in the process to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. In addition the Navy has agreed to provide the USEPA and GEPA with similar notice, in the event of a federal-to-federal transfer of property. Upon completion of the transfer the Navy shall provide a copy of the executed deed or transfer document(s) to the USEPA and GEPA.

In general, no intrusive activities shall occur within the designated LUC area at Site 8. All dig and construction permits relevant to Site 8 will be documented in the LUCMP for Site 8. If intrusive activities were necessary within the designated LUC area they would require prior approval of 36 CES/CEVR. If intrusive activities were conducted within the designated LUC area, the work would require an approved health and safety plan and procedures for the proper handling and disposal of displaced wastes and/or soils. This requirement shall be subject to an annual review and will remain in effect indefinitely as long as COCs in surface and subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

4.5 Progress Since the Last Five –Year Review

This is the first five-year review for this site.

4.6 Five-Year Review Process

4.6.1 Administrative Components

Andersen AFB has conducted a five-year review of the remedial actions implemented at Site 8. This review was conducted from February 2012 to September 2014. This report documents the results of the review. The review was conducted by PCR Environmental, Inc. under Contract Task Order 009 of Contract N62742-09-D-1953.

4.6.2 Community Notification and Involvement

Community Acceptance was evaluated based on comments received at the Public Meeting to present the Proposed Plan for Sites 5 and 8 held on 2 August 2007. Also the public was asked for written comments during the Public Comment Period from 26 July 2007 to 26 August 2007. The *ICs and ECs* alternative is acceptable to the community given that Site 8 will be appropriately managed and contained on USAF property and the identified risks will be mitigated in accordance with CERCLA.

Agency and public participation in the decision process for environmental activities has been encouraged throughout the site closure processes. Community and regulatory agencies have provided regulatory input through periodic RAB meetings. These meetings will continue until the CERCLA processes are complete. Information concerning the five-year review process and its findings will be presented to the public during these routine project team meetings. The last

RAB meeting was held in September 2012; however, Site 8 was not discussed during this meeting.

4.6.3 Document Review

This five-year review consisted of a review of relevant documents including the Land Use Control Management Plan for Andersen AFB, annual LUC inspection reports, and groundwater monitoring data. The 2007 ROD was reviewed for site history and remedial actions. The ROD was also reviewed, along with applicable ARARs, such as the 2004 EPA PRGs and 2013 EPA RSLs, for the discussion of exposure assumptions, toxicity data, cleanup levels and remedial action objectives for the site. A list of these documents is presented below:

- *Final Record of Decision for Sites 5 and 8 Main Base Operable Unit, Andersen Air Force Base, Guam. August. (EA, 2007b)*
- *Final Spring 2008 Groundwater Monitoring Report for Andersen Air Force Base, Guam (EA, 2008)*
- *Final Fall 2008 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2009a)*
- *Final Spring 2009 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2009b)*
- *Final Fall 2009 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2010a)*
- *Final Spring 2010 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2010b)*
- *Final Spring 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2011a)*
- *2011 Annual LUC Monitoring Checklists for IRP Site 8, Andersen AFB, Guam (PCR, 2011b)*
- *2012 Annual LUC Monitoring Checklists for IRP Site 8, Andersen AFB, Guam (PCR, 2012b)*
- *2013 Annual LUC Monitoring Checklists for IRP Site 8, Andersen AFB, Guam (PCR, 2013c)*
- *Final Spring 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2011a)*
- *Final Fall 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2012a)*
- *Final Spring 2012 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2012d)*
- *Final Fall 2012 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2013a)*
- *Final Spring 2013 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2013b)*
- *Draft Fall 2013 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2014a)*
- *Land Use Control Management Plan for Sites 2, 5, 6, 8, 9, 12, 20, 35. Andersen Air Force Base, Guam. September (PCR, 2012c)*
- *USEPA Region 9 PRG Table. (USEPA, 2004)*
- *USEPA Regional Screening Level (RSL) Summary Table. (USEPA, 2013)*

Numerous other documents have been cited in the preparation of this five-year review, and are found in the References section.

4.6.4 Data Review

Since the ROD was issued in 2007, eleven (11) rounds of the LTGM Program for the Main Base OU have been completed. Groundwater samples have been collected on a semi-annual basis from three (3) monitoring wells located within a 0.5-mile radius of Site 8. Two of the wells (IRP-51 and USGS-15) are located within Landfill 10C. Monitoring well IRP-42 appears to be located cross gradient from the site. The groundwater samples collected from all three wells were analyzed for VOCs, PAHs, and chlorides.

Analytical results for the eleven (11) rounds of sampling since 2007 were consistent with previous groundwater data. Target analytes were never detected or detected at levels below the SDWA MCL in groundwater samples collected from IRP-42. Trichloroethene (TCE) was found at concentrations exceeding the MCL in groundwater samples collected from USGS-150 (screened near the top of the freshwater lens) and IRP-51 (screened near the base of the freshwater lens). The source of this contamination in the groundwater collected from these wells is unknown.

No other sampling or environmental data have been collected for this site.

4.6.5 Site Inspection

Annual LUC site inspections have been conducted each year at Site 8 since the establishment of LUCs in 2007. The purpose of the inspections is to assess the protectiveness of the LUCs. LUCs at this site include warning signage, prohibitions on excavation activities and disturbance of the soil. No evidence of human activities that violate the LUCs has been observed during site inspections. The most recent site inspection for Site 8 was conducted on June 13, 2013.

The Annual LUC Compliance Certificates and photograph logs for this site are included as Appendix 2.

4.6.6 Interviews

As part of the Five-Year Installation Review, interviews were conducted with various parties. Mrs. Carmen Denton, Lab Services Administrator for Guam Waterworks Authority was interviewed on March 22, 2012. Mr. Michael Cruz representative from GEPA was interviewed on March 27, 2012. Overall the interviewees were pleased with the status of the Site 8 LUCs and the responsiveness of the IR program and staff. No significant problems regarding the site were identified during these interviews.

Most interviewees made recommendations that RAB meetings should be held more regularly, citing that planned quarterly meetings are often cancelled. The regularity of these meetings assures communication between the Navy and the community. Additionally, interviewees believe that the program would improve with more community involvement at the RAB meetings, and active recruiting should occur to increase RAB participation.

Mr. Cruz from GEPA stated that he would like to see the Air Force IR personnel conduct more frequent site visits to all IR sites to assure that LUCs are being maintained.

The content of the interviews was recorded and presented in Appendix 1.

4.7 Technical Assessment

These technical assessment questions have been presented by USEPA in the “Comprehensive Five-Year Review Guidance” report of June 2001, and are considered a part of the review process that should be addressed.

4.7.1 Question A: Is the remedy functioning as intended by the decision documents?

Review of the final ROD, other relevant documents, ARARs, risk assumptions, annual LUC site inspections, and five-year review site reconnaissance results indicate that selected remedy, although not fully implemented, is functioning as intended.

4.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy site selection still valid?

There have been no significant changes in the assumptions, toxicity data, clean up levels, assessment methodologies, or RAOs for this site that would require the risk assessment models to be redone or that would call into question the protectiveness of the remedy for this site.

The 2013 residential soil RSLs for antimony, dieldrin and lead (31, 0.03, 400 mg/kg respectively) are the same as the 2004 Residential PRG values used to select the remedy for this site. The cleanup goals for this site for antimony and lead were set to either the 2004 PRG or the BTV, whichever value was higher. The dieldrin cleanup goal of 2.8 mg/kg was established based on the non-cancer remedial goal.

No new contaminants have been identified for this site.

Table 4-2: Site 8 PRG/RSL Summary

	2004 PRGs Residential mg/kg	2013 RSL Residential mg/kg	Cleanup Goal mg/kg
Antimony	31	31	63 (BTV)
Dieldrin	0.03	0.03	2.8
Lead	400	400	800

4.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new ecological or human risks have been identified, and no weather-related or other event has affected the protectiveness of the remedy. The LUCs are in place and continue to prevent exposure. No other information has been found that would call into question the protectiveness of the remedy.

No data from the LTGM Program has been found that would call into question the protectiveness of the remedy at this site.

4.7.4 Technical Assessment Summary

The review of documents, ARARs, and risk assumptions and the site inspection results indicate that the selected remedy, although not fully implemented, is functioning as intended.

No change has occurred in the toxicity factors for the COPCs that were used in the risk assessments, and no significant change has occurred to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

4.8 Issues

The following LUCs, specified in the ROD, have not been implemented and are planned for 2014

- In the Base General Plan, identify the designated LUC area as prohibited from future residential development. (The LUCs will be implemented through amendments to the BGP that will effectively act as deed restrictions.)
- Survey and Mark LUC Boundaries. Perform survey to locate and install permanent markers to mark the corners of the designated LUC areas. Signs will be posted around the perimeter of the site

4.9 Recommendations and Follow-up Actions

Implement those LUCs that have not yet been implemented.

4.10 Protectiveness Statement

The remedy at Site 8 is protective of human health and the environment in the short term. It will be fully protective after the LUCs have been fully implemented. Exposure pathways that could result in unacceptable risks due to exposure to, or the ingestion of, contaminated soil are being controlled through partial fencing, signage, and the implementation of institutional controls. The continued protectiveness of the remedy is verified through annual LUC site inspections which monitor the site for excavation or uncontrolled removal of soil, and unauthorized development or new structures. Full implementation of the LUCs is required for this site to be in compliance.

4.11 Next Review

The next Installation Review is due five years from the USEPA's approval of this review.

4.12 Site 8 Annual LUC Compliance Inspection Reports

See Appendix 2 for LUC Compliance Inspection Reports for Sites 5, 6, 8 and 12 for years 2011 to 2013

5. Site 12

5.1 Introduction

The purpose of this Five-Year Review report is to determine whether the remedy at Site 12, Andersen AFB, Guam (Figures 4-1 & 4-2) is protective of human health and the environment by reducing the potential for exposure to low levels of chemicals in soil at the site. This Five-Year Review report is required due to contamination above levels which would allow for unrestricted land use and unlimited exposure.

This Five-Year Review report identifies issues found during this review, if any, and lists recommendations to address them.

This site's LUCs are presented below:

LUC Requirement/Description	LUC Interval	Starting Date
Survey and Mark LUC Boundaries	Initially	Planned for 2014
Install protective signage	Initially	December 2007
The BGP will be amended to identify the designated LUC area(s) as restricted from transfer/lease and residential development indefinitely as long as site conditions are not suitable for unrestricted use and unlimited exposure	Annually	Planned for 2014
Update GeoBase to include areas to be managed under LUCs	Annually	Planned for 2014
Chain link fence shall be installed at access points at the top of Areas A and B to limit access to the designated LUC areas.	Initially	Planned for 2014
Require Dig and Construction Permits prior to intrusive activities within the LUC area.	Initially	December 2007
Perform annual site inspection and prepare Compliance Summary Report	Annually	December 2008
Perform formal 5-year reviews as required by CERCLA. The 5-year reviews will continue as long as COCs remain at levels above those suitable for unrestricted use of the site.	Once Every Five Years	2014



Project: Five-Year Installation Review Report
Description: Location of Site 12

Figure 5-1



Project: Five-Year Installation Review Report

Description: LUC Site Diagram of Site 12

Figure
5-2

5.2 Site Chronology

Table 5-1: Chronology of Site Events for Site 12

Event	Date
Site Construction	1945
Disposal of sanitary wastes, excess equipment, Ni Cd batteries	1945-1984
Site closed	1985
Phase 1 Records Search	1985
RCRA Facility Assessment	1986
Initial Community Relations Plan	1993
Federal Facility Agreement (FFA)	1993 Mar
Updated Community Relations Plan	1998
Restoration Advisory Board (RAB)	1995
Final Records Search	1996
Site recon and DSI	1999
Site sampling	1999 Dec-2000 Jul
RI/FS	2006
HHRA and SRA (in RI)	2006
Public meeting to present Proposed Plan	2006
ROD	2007 Aug
Remedial Action	2007 Nov-2008 Oct
Annual LUC Inspections	2008
Remedial Action Completion Report	2009
Annual LUC Inspections	2009 - 2013
LUCMP	2012 Sep
Annual LUC Inspection	2013
5 Year Review Report: INITIAL	2014

5.3 Background

Site 12 is located in the northern portion of the Main Base OU at Andersen AFB, Guam (Figure 4-1). Site 12 is located along the cliff line north of the active runways, and covers an area of approximately 24 acres. It is comprised of six sub-sites, referred to as Areas A through F, which are adjacent to the former Weapons Storage Area (WSA). Topography of Site 12 varies from a relatively flat limestone plateau to a steep cliff line.

Area A is approximately 3 acres in size and is located at the westernmost portion of Site 12. Elevations at Area A range from 400 feet above msl along the base of the cliff line, to 575 feet above msl at the top of the cliff line (Figure 4-1). The majority of Area A lies along the slope and is characterized by limestone outcrops at the cliff face. It is located along the cliff line, and is situated predominantly on the reefal facieses of the Mariana Limestone. The depth to groundwater may vary from approximately 500 feet bgs at the top of the cliff line to approximately 390 feet bgs along the lower portion of the site located below the cliff line.

Area B, located approximately 600 feet east of Area A, is approximately 9 acres in size. Half of Area B is situated along the cliff line slope and the other half is located atop the grassy plateau. Area B ranges in elevation from 585 feet above msl at the top of the plateau to 465 feet above msl along the slope. Many small, 1- to 3-foot high mounds were observed on the plateau at the top of Area B. One large mound (60 feet by 30 feet by 90 feet), located near the edge of the cliff

line, was used as the backdrop for the small arms range lateral target.

Area C, located approximately 1,500 feet east of Area B, occupies less than 1 acre along the cliff line slope. Elevations at Area C range from 620 feet above msl on the plateau to 465 feet above msl along the cliff line slope.

Area D, located approximately 500 feet east of Area C, is similar in size and physical characteristics to Area C. Elevations at Area D range from 610 feet above msl on the plateau to 450 feet above msl along the cliff line slope.

Area E, located approximately 300 feet east of Area D, is 9 acres in size, with approximately 5 acres located along the steep hillside and the remaining 4 acres situated on the top of the plateau. This area is comprised of thick shrubs and trees with small debris mounds containing fill. Elevations at Area E range from 610 feet above msl on the plateau to 275 feet above msl near its base. The southwest portion of this area is characterized by a limestone outcrop that forms the steep cliff line slope. On the northeast edge of the plateau is an area of large limestone boulders that appear to have been quarried from the bedrock. These boulders may have been used as tools for the clearing of vegetation at the different areas of Site 12 and would have allowed for easy disposal of debris down the cliff. The base of the site contains similar boulders that have two-inch-diameter holes that may have been drilled during the quarrying.

Area F (previously designated as Pati Point Dumpsite) is located approximately 400 feet east of Area E. The area is less than 2 acres in size and is situated at the base of a 170-foot vertical cliff. Due to the vertical cliff there was no topographic map generated for this area.

The site is located within a relatively remote (and restricted) area along the periphery of the active flight line that is not generally accessed. Sub-sites A and B shall be restricted from future residential development due to: (1) proximity to the active flight line, (2) proximity to the WSA, and (3) proximity to the United States Fish and Wildlife "overlay". There is no fencing or other engineering controls currently at the site though the fencing that encloses the flight line helps to restrict access. The land will be restricted from future residential development through implementation of LUCs that will be amended into the BGP that will effectively act as deed restrictions. The LUCs would specifically restrict recreational, industrial, and commercial development below the cliff line in addition to residential development.

5.3.1 History of Contamination

According to the IRP Phase I Records Search (ESE, 1985), Site 12 consisted of approximately 2.5 acres and was used between 1945 and 1949 for disposal of sanitary trash and excess equipment such as trucks and airplane parts. According to the report, the waste materials were disposed of over the steep-walled cliff onto the lower terraces.

Between 100 and 200 drums were observed in the area of Site 12. Most of the drums were crushed, empty, and partially buried, and appeared to contain limestone boulders. Metal debris was observed throughout the area, and approximately 75 nickel-cadmium (NiCad) batteries were noted in the area known as the Pati Point Dump.

Site 12 was described as occupying 23 acres, active from late 1940s to 1984, and containing sanitary trash, excess equipment, NiCad batteries, and empty paint drums. USAF documentation confirms that an over-the-cliff trash dump at Site 12 started as early as 1952 and that access to the site was restricted beginning in 1985.

In 1963, a small-arms range was constructed at Area B. The range consisted of a "Range Control House" (Facility T -204 7) and a "Lateral Moving Target" (Facility T -2043). Facility T -204 7 was an L-shaped structure. During Typhoon Karen, in November 1962, the building was partially or completely destroyed and was removed from Real Property records in November 1963. Facility T -2043 was a long, linear structure that was used in conjunction with a large earthen mound located near the cliff line that was used as a backdrop for a shooting range. As a result, spent bullets and shell casings are scattered throughout the vicinity of the mound. Facility T-2043 was reassigned as Facility 51203 sometime between April 1965 and September 1967, when it was abandoned in place and the facility was deleted from the Real Property records.

5.3.2 Initial Response

Site 12 was included in the IRP Phase I Records Search but did not receive a HARM score. No site visit was conducted because of the site's isolated location and heavy vegetation. The report identified the site as having minimal potential for contamination and recommended that the USAF eliminate it from further consideration.

The 1986 RFA Report (SAIC, 1986) falsely identified Site 12 as the EOD area located on the north beach approximately 10 feet above msl. Due to this error, the area described as Site 12 in the IRP Phase I Records Search Report was not investigated during the 1986 RFA. Site 12 was not included during the Phase II investigation, Stages 1 and 2 (Battelle, 1989 and SAIC, 1991). Site 12 was described in the IRP Phase II, Stage 1 Final Report, but was not investigated during Stage 1 activities based on the decision process discussed in the Phase I Records Search. The site was removed from further consideration. In 1992, field observations completed in conjunction with the OU6 Base wide Work Plan (ICF, 1994a) and the Work Plan Addendum to OU6 for OU5 (ICF, 1994b) estimated the size of Site 12 as approximately 23 acres.

An 8 November 1990 memorandum from the Headquarters 633rd Air Base Wing requested the inclusion of four additional sites, including the Pati Point Dumpsite, in the Andersen AFB IRP. The memo stated that the Pati Point Dumpsite, located at the bottom of the cliff, was littered with NiCad batteries, empty paint drums, and potentially live 50-caliber cartridges. The site was suspected of being active in the late 1950s; however, access was restricted in 1985 after a fence was installed (ICF, 1996).

A field investigation of Site 12 was completed in 1999 through 2000 and the results of that investigation are incorporated in the *Remedial Investigation (RI) for Sites 6, 9, and 12 - Volume 1* (EA, 2006).

A site reconnaissance and DSI were conducted at Areas A through F in 1999 to accurately characterize the environmental setting and boundaries of each area, including identification of potentially hazardous wastes. During the DSI, the physical characteristics of each area and areas containing surface debris that may be potential sources of contamination were documented. An ecological survey was performed at Area A in January 2000 and two endangered species were observed within close proximity of Site 12.

Prior to the RI, there was no sampling performed at Area A through F. For area A, a total of 30 surface soil samples, including three duplicate samples, were collected during two sampling events. Fourteen surface soil samples, including one duplicate sample, were collected and analyzed for VOCs, PAHs, pesticides, PCBs, and 24 inorganic metals in January 2000. Based on these analytical results, a second sampling event was conducted in July 2000 to delineate

contamination around sample locations with concentrations that exceeded screening levels (residential PRGs and BTV's). Eight subsurface soil samples, including one duplicate, were collected from Area A in February 2000 and were analyzed for VOCs, VOCs, PAHs, pesticides, PCBs, and inorganic metals. Based on the initial sample results, two confirmatory subsurface soil samples were collected in July 2000. These samples were analyzed for PAHs, pesticides, and specific inorganic metals. One composite sample was collected from a drum at Area A in February 2000 and analyzed for VOCs, total petroleum hydrocarbons (TPH), and PCBs.

A total of 76 surface soil samples (including six duplicate samples) were collected at Area B from depths of 0 to 0.5 feet bgs. Samples were collected at Area B during two field efforts, December 1999 and July 2000. In December 1999, 37 surface soil samples, including three duplicate samples, were collected and analyzed for VOCs, PAHs, pesticides, and inorganic metals. Based on the initial sampling analytical results, additional samples were collected in July 2000 to delineate contamination around sample locations with concentrations that exceeded screening levels (residential PRGs and BTV's). As none of the 37 surface soil samples submitted for SVOC, pesticide, or PCB analyses had concentrations that exceeded residential PRGs, no surface soil confirmatory samples were submitted for these parameters. Thirty-nine confirmatory samples, including three duplicate samples, were collected and were selectively analyzed for PAHs (30 samples), aluminum (nine samples), antimony (five samples), arsenic (five samples), chromium (five samples), lead (16 samples), and manganese (nine samples). Twenty-nine subsurface soil samples (including three duplicate samples) were collected from test pits that were excavated at Area B. Twelve subsurface soil samples were collected in January and February 2000 and analyzed for VOCs, VOCs, PAHs, pesticides, and inorganic metals. Seventeen confirmatory samples, including three duplicate samples, were collected in July 2000 and analyzed for PAHs (in each of the samples) and for lead (in only four of the samples). One drum sample (Q002) was collected at Area B in February 2000 and analyzed for VOCs.

A total of 14 test ditches were excavated on the Area B plateau. The ditches ranged from 12 to 89 feet in length, and were excavated to an average depth of 2.75 feet bgs. Six of the 14 test ditches contained fill material, which included fragments of clay pigeon targets, metal angle iron, concrete blocks, a metal container, metal strapping, and bullet and shotgun shell casings. Ordnance or explosive waste (OEW) material identified during test ditch excavations included 30-and 50-caliber shell casings.

A total of three surface soil samples were collected at Area C in June 2000 and were analyzed for SVOCs, PAHs, and inorganic metals. One subsurface soil sample was collected and analyzed for SVOCs, PAHs, and inorganic metals.

A total of three surface soil samples were collected at Area D in June 2000 and were analyzed for PAHs, pesticides, and inorganic metals. One subsurface soil sample was collected at Area D in June 2000 and analyzed for PAHs, pesticides, PCBs, and inorganic metals. The small amounts of debris that were observed at Area D included: barbed wire, fence posts with concrete footings, an empty alodine bottle, a telephone pole, metal brackets, cement blocks, galvanized pipe, electrical wire, construction debris, and sanitary trash.

A total of 43 surface soil samples (including four duplicate samples) were collected at Area E during two sampling events. From December 1999 to January 2000, 22 surface soil samples, including two duplicate samples, were collected and analyzed for SVOCs, PAHs, pesticides, PCBs, and inorganic metals. Twenty-one confirmatory samples, including two duplicate samples, were collected in June 2000 and analyzed for PAHs (seven samples), pesticides (seven samples), chromium (five samples), copper (five samples), and lead (four samples).

Eleven subsurface soil samples, including two duplicate samples, were collected at Area E in January/February 2000 and were analyzed for VOCs, PAHs, pesticides, PCBs, and inorganic metals. Three drum samples were collected at Area E in February 2000 and analyzed for VOCs, TPR, PCBs, and reactivity-ignitability-corrosivity.

Of the 38 grid cells that make up Area E, approximately 16 are located on the plateau above the cliff line. Areas of scattered debris were observed along the top of the cliff line along with fill and buried trash, to an approximate depth of approximately 9 feet bgs. Observed surface and subsurface debris included: alodine and deoxidine bottles, 55-gallon drums, 3-gallon containers, dried resin-like material, mechanical parts, electrical parts, and construction debris. The portion of Area E located down slope is comprised of approximately 22 grid cells. Fill material extends approximately 400 feet down the slope and is approximately 400 feet wide. More than 80 drums were observed along the slope; however, the exact number of drums was difficult to determine, as much of the slope was unstable. Five drums contained a petroleum-like liquid; three of the drums were approximately 80 percent full with an unknown liquid, and two drums were approximately 10 percent full. Other debris observed included grease canisters, respirator cartridges, 6-inch-diameter POL pipe, aircraft parts, 500-pound bomb end-caps, hardened paint, vehicle parts, rubber tires, construction debris, and sanitary trash. A total of 14 test ditches were excavated on the plateau at the top of Area E. The ditches ranged from 27 to 100 feet in length and to an average depth of 3.5 feet bgs, where bedrock was encountered. Debris was observed in 9 of the 10 test ditches and included aluminum aircraft parts, sheet metal, glass bottle, electrical wire, solid asphalt, and concrete blocks. Two separate pieces of OEW (expended incendiary bomblets) were observed in two of the test ditches.

A total of eight surface soil samples, including one duplicate, were collected during two sampling events. Five surface soil samples, including one duplicate sample, were collected during January 2000 and analyzed for SVOCs, PAHs, pesticides, PCBs, and inorganic metals. Three confirmatory surface soil samples were collected in June 2000 and analyzed for cadmium. Two drum samples were collected at Area F in February 2000 and analyzed for VOC and reactivity, ignitability, and corrosivity.

5.3.3 Basis for Taking Action

Site 12 consists of six Sub-sites: 12A, 12B, 12C, 12D, 12E, and 12 F. COC concentrations in surface and surface soil at Sub-sites 12C, 12D, 12E and 12F pose no unacceptable risks to human or ecological receptors and as such: (1) No Action is warranted and (2) the land is eligible for unrestricted use and unlimited exposure.

Sub-sites 12A and 12B, contain COCs in subsurface soil at concentrations that pose potential unacceptable risks to human receptors but no COCs in surface or subsurface soil at concentrations exceeding the remedial goals for ecological receptors.

The 2007 ROD for Site 12 provides the following information on COCs for Areas A, B, and F prior to the remedial action performed between November 2007 and October 2008:

Area A

The COCs that were identified in surface soil at Site 12 Area A include antimony, arsenic, copper, lead, manganese, benzo(a)pyrene, dichlorodiphenyldichloroethene (DDE), dichlorodiphenyltrichloroethene (DDT), and dieldrin. The COCs that were identified in subsurface soils at Site 12 Area A include lead, benzo(a)anthracene, benzo(a)pyrene, and DDE. These COCs pose potential unacceptable risks to human health (resident adults and children). The COCs that were identified as posing potential

unacceptable risks to the ecological receptors include copper, lead, dichlorodiphenyldichloroethane (DDD), DDE, and DDT.

Area B

The COCs that were identified in surface soils at Site 12 Area B include aluminum, antimony, arsenic, chromium, lead, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. The COCs that were identified in subsurface soils at Site 12 Area B include aluminum, chromium, lead, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. These COCs pose potential unacceptable risks to human health (resident adults and children). The COCs that were identified as posing potential unacceptable risks to the ecological receptors include lead and zinc.

Area C

There were no COCs identified for the surface and subsurface soils at Site 12 Area C.

Area D

There were no COCs identified for the surface and subsurface soils at Site 12 Area D.

Area E

Manganese was the only COC that was identified in surface soils at Site 12 Area E. However, the maximum detected concentration of manganese (3,490 milligrams per kilogram [mg/kg]) is less than its BTV (5,500 mg/kg); therefore, no cleanup for manganese is required. There were no COCs identified in the subsurface soils at Site 12 Area E. There were no COCs that were identified as posing potential unacceptable risks to the ecological receptors at Site 12 Area E.

Area F

The COCs that were identified in surface soils at Site 12 Area F include cadmium and nickel. These COCs pose potential unacceptable risks to both human health (resident adults and children) and ecological receptors. There were no COCs identified in the subsurface soils at Site 12 Area F.

The remedial action project objectives were to remove contaminated soil and associated solid waste debris down to a depth of 2 feet below ground surface from the delineated hot spot boundaries at Areas A, B, and F. The remedial goals addressed ecological receptors and therefore not all of the contaminated soil and/or debris was removed at each Area. Based on the risk assessment and site cleanup objectives, the following COCs were identified for each area of the site:

- Area A - lead, copper, DDT, and DDE
- Area B – lead
- Area F - cadmium and nickel

5.4 Remedial actions

5.4.1 Remedy Selection

The selected remedies at each of the Sub-sites were as follows:

- Area A: Soil Removal Protective of Ecological Receptors with ICs.
- Area B: Soil Removal Protective of Ecological Receptors with ICs.
- Area F: Soil Removal Protective of Ecological Receptors (also protective of resident adults and children so ICs are not required).

The remedial actions performed at Site 12 were as provided in the July 2007, Final Record of (EA, 2007c). The selected remedy for Areas A, B, and F is "Soil Removal Protective of Ecological Receptors." This remedy eliminated contaminated soil exceeding the remedial goals for ecological receptors and implements LUCs protective of human health.

Project objectives were to remove and dispose of soil contaminated with site-specific COCs in excess of the ecological receptors cleanup levels to 2 feet below ground surface, dispose of associated contaminated soil and solid waste debris from the site, collect confirmation soil samples to document the concentrations of COCs remaining in place, and backfill the excavation areas with a minimum of 1 foot of clean coral fill material. Additionally, the remedial actions were to be conducted such that minimal damage was caused to the native limestone forest that is within the Guam National Wildlife Refuge and habitat for endangered wildlife species. The Area-specific COCs consisted of copper, lead, DDT, and DDE for Area A; lead for Area B; and nickel and cadmium for Area F.

5.4.2 Remedy Implementation

The field scope of the remedial action was reduced at the request of U.S. Fish and Wildlife Service in a manner that minimized disturbance of the sensitive native limestone forest. The reduced scope remained protective of identified ecological receptors inasmuch as significant sources of contamination (nickel-cadmium batteries) were successfully removed. With regards to potential human exposures, LUCs that restrict any future development of the site, as provided in the Final ROD (EA, 2007c), have been implemented for the site. Additionally, an engineering control consisting of a chain-link fence and gate has been installed by the U.S. Air Force along the access road leading to Area F. This feature will further restrict physical access to the site by humans.

The following remedial actions were performed between November 2007 and October 2008:

- Preconstruction survey
- Preconstruction delineation and in-place waste characterization soil sampling
- Geotechnical subsurface investigation
- Excavation of contaminated soil and associated debris
- Removal of solid debris (consisting of metallic debris, spent munitions, lead-acid batteries and battery parts, nickel-cadmium batteries and battery parts, and lead paint)
- Confirmation soil sampling
- Backfilling and compaction of excavated areas
- Placement and compaction of contaminated soil within the CU
- Site restoration (consisting of topsoil placement and erosion control blanket installation)
- Demobilization of equipment and materials

The results from in-place waste characterization samples were used to characterize the contaminated soil and associated debris as Resource Conservation and Recovery Act nonhazardous waste.

During the remedial actions, the types and quantities of waste removed from the site included the following:

- Approximately 1,899 loose cubic yards of contaminated soil and associated solid debris. The contaminated soil and debris was characterized as nonhazardous and was disposed of in the CU.
- Approximately 10 tons of ferrous scrap metal, and approximately 1,162 kilograms of copper wire. The metallic scrap was transported to an on-island recycling facility.
- One gas cylinder. The gas cylinder was certified gas-free and disposed of as metallic scrap.
- Two 5-gallon buckets of yellow lead-based paint. The lead-based paint was characterized as Resource Conservation and Recovery Act-hazardous waste and transported and disposed of at an off-island hazardous waste disposal facility in accordance with GEPA, EPA, and DOT regulations.
- Three 55-gallon plastic drums of nickel-cadmium batteries and battery casings. The batteries were characterized as hazardous and were transported and disposed of at an off-island hazardous waste disposal facility in accordance with GEPA, EPA, and DOT regulations.
- One 55-gallon plastic drum of lead-acid batteries and battery casings. The batteries were characterized as hazardous and were transported and disposed of at an off-island disposal facility in accordance with GEPA, EPA, and DOT regulations.
- One munitions box (less than 1 cubic foot in size) containing small arms munitions (bullets). This waste was transported to Andersen Air Force Base Explosive Ordnance Disposal for disposal.
- Confirmation soil samples were collected from the excavated areas and analyzed for site-specific COCs at Areas A and B. These sample results document the concentrations of COCs remaining in-place at the site.

Nonhazardous soil and associated non-recyclable debris from the site was transported in dump trucks and placed into the CU Cell No.1. The contaminated soil and debris was spread into 2-foot lifts and compacted.

The excavations at Areas A and B were backfilled with a minimum of 1 foot of clean coral fill material (generated during construction of Cell No. 2 at the CU). As a result of potential stability issues due to the steepness of the slope, a larger volume of backfill was placed than was originally planned. Areas A and B were then restored by placing a 2 to 3 inch layer of topsoil over the backfill material to encourage growth of native shrubs, plants, and trees. Finished grades were constructed to ensure proper flow of storm water runoff and to avoid ponding. Biodegradable jute blanket was installed over the topsoil for erosion control during natural revegetation.

Following the removal of 2 feet of surface soil containing contaminated soil and associated debris above the respective cleanup levels to the extent feasible, backfilling the excavation areas with a minimum of 1 foot of clean coral material, and documenting the contamination left

in-place on site, the project objectives for these remedial actions were met. No further action is recommended with respect to the remedial activities performed (Shaw, 2009).

Site 12 is located on the active portion of the Main Base and there are no plans for the Navy to lease or transfer the property. In the event the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. In the event of a transfer of the property the Navy will provide the USEPA and GEPA with six (6) months prior notice to the transaction so that they can be involved in the process to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. In addition the Navy has agreed to provide the USEPA and GEPA with similar notice, in the event of a federal-to-federal transfer of property. Upon completion of the transfer the Navy shall provide a copy of the executed deed or transfer document(s) to the USEPA and GEPA.

In general, no intrusive activities shall occur within the designated LUC area at Site 12. All dig and construction permits relevant to Site 12 will be documented in the LUCMP for Site 12. If intrusive activities were necessary within the designated LUC area they would require prior approval of 36 CES/CEVR. If intrusive activities were conducted within the designated LUC area, the work would require an approved health and safety plan and procedures for the proper handling and disposal of displaced wastes and/or soils. This requirement shall be subject to an annual review and will remain in effect indefinitely as long as COCs in subsurface soil remain at concentrations that prevent unrestricted use and unlimited exposure.

With respect to engineering controls, warning signs have been posted along the periphery of the designated LUC area that clearly identify the designated LUC area, and include contact information for 36 CES/CEVR. These requirements are monitored annually as part of the operations and maintenance activities.

5.5 Progress Since the Last Five –Year Review

This is the first five-year review for this site.

5.6 Five-Year Review Process

5.6.1 Administrative Components

Andersen AFB has conducted a five-year review of the remedial actions implemented at Site 12. This review was conducted from February 2012 to September 2014. This report documents the results of the review. The review was conducted by PCR Environmental, Inc. under Contract Task Order 009 of Contract N62742-09-D-1953.

5.6.2 Community Notification and Involvement

Agency and public participation in the decision process for environmental activities has been encouraged throughout the site closure processes. Community and regulatory agencies have provided regulatory input through periodic RAB meetings. These meetings will continue until the CERCLA processes are complete. Information concerning the five-year review process and its findings will be presented to the public during these routine project team meetings. The last RAB meeting was held in September 2012; however, Site 12 was not discussed during this meeting.

5.6.3 Document Review

This five-year review consisted of a review of relevant documents including the Land Use Control Management Plan for Andersen AFB, annual LUC inspection reports, and groundwater monitoring data. The 2007 ROD was reviewed for site history and remedial actions. The ROD was also reviewed, along with applicable ARARs, such as the 2004 EPA PRGs and 2013 EPA RSLs, for the discussion of exposure assumptions, toxicity data, cleanup levels and remedial action objectives for the site. A list of these documents is presented below:

- *Final Record of Decision for Sites 6, 9 and 12, Main Base Operable Unit, Andersen Air Force Base, Guam. August. (EA, 2007c)*
- *Final Spring 2008 Groundwater Monitoring Report for Andersen Air Force Base, Guam (EA, 2008)*
- *Final Fall 2008 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2009a)*
- *Final Spring 2009 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2009b)*
- *Final Fall 2009 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2010a)*
- *Final Spring 2010 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (EA, 2010b)*
- *Final Spring 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2011a)*
- *2011 Annual LUC Monitoring Checklists for IRP Site 8, Andersen AFB, Guam (PCR, 2011b)*
- *2012 Annual LUC Monitoring Checklists for IRP Site 8, Andersen AFB, Guam (PCR, 2012b)*
- *2013 Annual LUC Monitoring Checklists for IRP Site 8, Andersen AFB, Guam (PCR, 2013c)*
- *Final Spring 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2011a)*
- *Final Fall 2011 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2012a)*
- *Final Spring 2012 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2012d)*
- *Final Fall 2012 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2013a)*
- *Final Spring 2013 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2013b)*
- *Draft Fall 2013 Groundwater Monitoring Report for Andersen Air Force Base, Guam. (PCR, 2014a)*
- *Land Use Control Management Plan for Sites 2, 5, 6, 8, 9, 12, 20, 35. Andersen Air Force Base, Guam. September (PCR, 2012c)*
- *USEPA Region 9 PRG Table. (USEPA, 2004)*
- *USEPA Regional Screening Level (RSL) Summary Table. (USEPA, 2013)*

Numerous other documents have been cited in the preparation of this five-year review, and are found in the References section.

5.6.4 Data Review

Since the ROD was issued in 2007, eleven (11) rounds of the LTGM Program for the Main Base OU have been completed. The only monitoring well located within a 0.25 mile radius of Site 12 is IRP 52. This well was removed from the LTGM program in 2003 as COCs were never detected at or above Safe Drinking Water Act maximum contaminant levels.

The RACR for Site 12 (Shaw, 2009) provides details of the remedial actions performed between November 2007 and October 2008 at the site, as well as the remedial actions performed at the CU.

No other sampling or environmental data have been collected for this site.

5.6.5 Site Inspection

Annual LUC site inspections have been conducted each year at Site 12 since the establishment of LUCs in 2007. The purpose of the inspections is to assess the protectiveness of the LUCs. LUCs at this site include warning signage, prohibitions on excavation activities and disturbance of the soil. No evidence of human activities that violate the LUCs has been observed during site inspections. The most recent site inspection for Site 12 was conducted on June 13, 2013.

The Annual LUC Compliance Certificates and photograph logs for this site are included as Appendix 2.

5.6.6 Interviews

As part of the Five-Year Installation Review, interviews were conducted with various parties. Mrs. Carmen Denton, Lab Services Administrator for Guam Waterworks Authority was interviewed on March 22, 2012. Mr. Michael Cruz representative from GEPA was interviewed on March 27, 2012. Overall the interviewees were pleased with the status of the Site 12 LUCs and the responsiveness of the IR program and staff. No significant problems regarding the site were identified during these interviews.

Most interviewees made recommendations that RAB meetings should be held more regularly, citing that planned quarterly meetings are often cancelled. The regularity of these meetings assures communication between the Navy and the community. Additionally, interviewees believe that the program would improve with more community involvement at the RAB meetings, and active recruiting should occur to increase RAB participation.

Mr. Cruz from GEPA stated that he would like to see the Air Force IR personnel conduct more frequent site visits to all IR sites to assure that LUCs are being maintained.

The content of the interviews was recorded and presented in Appendix 1.

5.7 Technical Assessment

These technical assessment questions have been presented by USEPA in the "Comprehensive Five-Year Review Guidance" report of June 2001, and are considered a part of the review process that should be addressed.

5.7.1 Question A: Is the remedy functioning as intended by the decision documents?

Review of the final ROD, other relevant documents, ARARs, risk assumptions, annual LUC site inspections, and five-year review site reconnaissance results indicate that selected remedy, although not fully implemented, is functioning as intended.

5.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy site selection still valid?

There have been no significant changes in the assumptions, toxicity data, clean up levels, assessment methodologies, or RAOs for this site that would require the risk assessment models to be redone or that would call into question the protectiveness of the remedy for this site.

No new contaminants have been identified for this site.

The cleanup goals for this site were set to either the 2004 industrial PRG or the BTV, whichever value was higher.

The 2013 PRGs/RSLs for contaminants at Areas A and B are discussed below.

Area A Surface Soil

With the exception of DDE, the 2013 industrial soil RSLs for COCs at this site have remained unchanged or have increased relative to the 2004 industrial soil PRGs. The 2013 industrial soil RSL for DDE (5.1 mg/kg), is lower than the 2004 industrial PRG value of 7.0 mg/kg, However, the project specific cleanup level of 61 mg/kg for this area was based on ecological receptors. LUCs were implemented for the protection of human health. (Shaw, 2009)

Table 5-2: Site 12 Area A Surface Soil PRG/RSL Summary

	2004 PRGs Industrial mg/kg	Cleanup Goal mg/kg	2013 RSL Industrial mg/kg
Antimony	410	410	410
Arsenic	1.6	62 (BTV)	2.4
Copper	41,000	41,000	41,000
Lead	800	800	800
Manganese	19,000	19,000	23,000
Benzo[a]pyrene	0.21	0.21	0.21
DDE	7.0	61*	5.1
DDT	7.0	7.0	7.0
Dieldrin	0.11	0.11	0.11

*The project-specific cleanup level is based on ecological risks.

Area A Subsurface Soil COCs

With the exception of DDE, the 2013 industrial soil RSLs for COCs at this site have remained unchanged relative to the 2004 industrial soil PRGs. The 2013 industrial soil RSL for DDE (5.1 mg/kg), is lower than the 2004 industrial PRG value of 7.0 mg/kg, However, the project specific cleanup level of 61 mg/kg for this was based on ecological receptors. LUCs were implemented for the protection of human health. (Shaw, 2009).

Table 5-3: Site 12 Area A Subsurface Soil PRG/RSL Summary

	2004 PRGs Industrial mg/kg	Cleanup Goal mg/kg	2013 RSL Industrial mg/kg
Lead	800	800	800
benzo(a)anthracene	2.1	2.1	2.1
benzo[a]pyrene	0.21	0.21	0.21
DDE	7.0	61*	5.1

*The project-specific cleanup level is based on ecological risks.

Area B Surface Soil COCs

With the exception of Aluminum, the 2013 industrial soil RSLs for COCs at this site have remained unchanged or have increased relative to the 2004 industrial soil PRGs. The 2013 industrial soil RSL for aluminum (99,000 mg/kg) is slightly lower than the 2004 industrial PRG value of 100,000 mg/kg.

For a discussion of chromium PRG/RSL, see note below.

Table 5-4: Site 12 Area B Surface Soil PRG/RSL Summary

	2004 PRGs Industrial mg/kg	Cleanup Goal mg/kg	2013 RSL Industrial mg/kg
Aluminum	100,000	173,500 (BTV)	99,000
Antimony	410	410	410
Arsenic	1.6	62 (BTV)	2.4
Chromium	(see chromium note below)	1080 (BTV)	(see chromium note below)
Lead	800	800	800
benz(a)anthracene	2.1	2.1	2.1
benzo(a)pyrene	0.21	0.21	0.21
benzo(b)fluoranthene	2.1	2.1	2.1
benzo(k)fluoranthene	21	21	21
dibenz(a,h)anthracene	0.21	0.21	0.21
indeno(1,2,3-c,d)pyrene	2.1	2.1	2.1

Area B Subsurface Soil COCs

With the exception of Aluminum, the 2013 industrial soil RSLs for COCs at this site have remained unchanged relative to the 2004 industrial soil PRGs. The 2013 industrial soil RSL for aluminum (99,000 mg/kg), is slightly lower than the 2004 industrial PRG value of 100,000 mg/kg.

For a discussion of chromium PRG/RSL, see note below.

Table 5-5: Site 12 Area B Subsurface Soil PRG/RSL Summary

	2004 PRGs Industrial mg/kg	Cleanup Goal mg/kg	2013 RSL Industrial mg/kg
Aluminum	100,000	173,500 (BTV)	99,000

Chromium	(see chromium note below)	1080 (BTV)	(see chromium note below)
Lead	800	800	800
benz(a)anthracene	2.1	2.1	2.1
benzo(a)pyrene	0.21	0.21	0.21
benzo(b)fluoranthene	2.1	2.1	2.1
benzo(k)fluoranthene	21	21	21
dibenz(a,h)anthracene	0.21	0.21	0.21
indeno(1,2,3-c,d)pyrene	2.1	2.1	2.1

Note Regarding Chromium PRG/RSL: The 2004 residential PRG for chromium (Cr) was 210 mg/kg of “total chromium”, the industrial PRG was 450 mg/kg. Since 2009, EPA has discontinued the use of total chromium, and has separated the RSLs for chromium into Cr III and Cr VI. EPA estimates these valences to occur in nature at a ration of 1:6 Cr VI:Cr III. The 2013 residential RSL for Cr VI is 0.29 mg/kg, the industrial RSL is 5.6 mg/kg. The cleanup goal established for total chromium at this site (based on the BTV) was 1080 mg/kg. Using the EPA ratio of 1:6, the presence of Cr VI at the site is approximately 154 mg/kg. Although this is well above the 2013 RSLs, since the background level of Cr VI at this site is approximately 154 mg/kg, it is not possible to clean up the site below this level, and thus the cleanup goal for Cr VI is effectively 154 mg/kg.

5.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new ecological or human risks have been identified, and no weather-related or other event has affected the protectiveness of the remedy. The LUCs are in place and continue to prevent exposure. No other information has been found that would call into question the protectiveness of the remedy.

No data from the LTGM Program has been found that would call into question the protectiveness of the remedy at this site.

5.7.4 Technical Assessment Summary

The review of documents, ARARs, and risk assumptions and the site inspection results indicate that the selected remedy, although not fully implemented, is functioning as intended.

The remedial actions performed between November 2007 and October 2008 eliminated contaminated soil exceeding the remedial goals for ecological receptors at Areas A and B and implemented LUCs protective of human health. For Area F, the remedial actions eliminated contaminated soil exceeding the remedial goals for both ecological and human receptors, and therefore no LUCs are required for Area F.

Therefore, toxicity factors for the COCs that were used in the risk assessments have been reduced. No significant change has occurred to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

5.8 Issues

The following LUCs, specified in the ROD, have not been implemented and are planned for 2014

- Survey and Mark LUC Boundaries
- The BGP will be amended to identify the designated LUC area(s) as restricted from transfer/lease and residential development indefinitely as long as site conditions are not suitable for unrestricted use and unlimited exposure
- Update GeoBase to include areas to be managed under LUCs
- Chain link fence shall be installed at access points at the top of Areas A and B to limit access to the designated LUC areas

5.9 Recommendations and Follow-up Actions

Implement those LUCs that have not yet been implemented.

5.10 Protectiveness Statement

The remedy at Site 12 is protective of human health and the environment in the short term. It will be fully protective after the LUCs have been fully implemented. Exposure pathways that could result in unacceptable risks due to exposure to, or the ingestion of, contaminated soil are being controlled through partial fencing, signage, and the implementation of institutional controls. The continued protectiveness of the remedy is verified through annual LUC site inspections which monitor the site for excavation or uncontrolled removal of soil, and unauthorized development or new structures. Full implementation of the LUCs is required for this site to be in compliance.

5.11 Next Review

The next Installation Review is due five years from the USEPA's approval of this review.

5.12 Site 12 Annual LUC Compliance Inspection Reports

See Appendix 2 for LUC Compliance Inspection Reports for Sites 5, 6, 8 and 12 for years 2011 to 2013

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Appendix 1. Meeting Records

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**Appendix 2. Annual LUC Compliance Inspection Reports For Sites 5, 6, 8 and 12 for Years
2011 to 2013**